Established 1916 as THE OIL WEEKLY

WORLD OIL

Drilling Contractors' Issue

SPECIALIZED FOR EXPLORATION, DRILLING, PRODUCING OPERATIONS AND MANAGEMENT

OCTOBER, 1954

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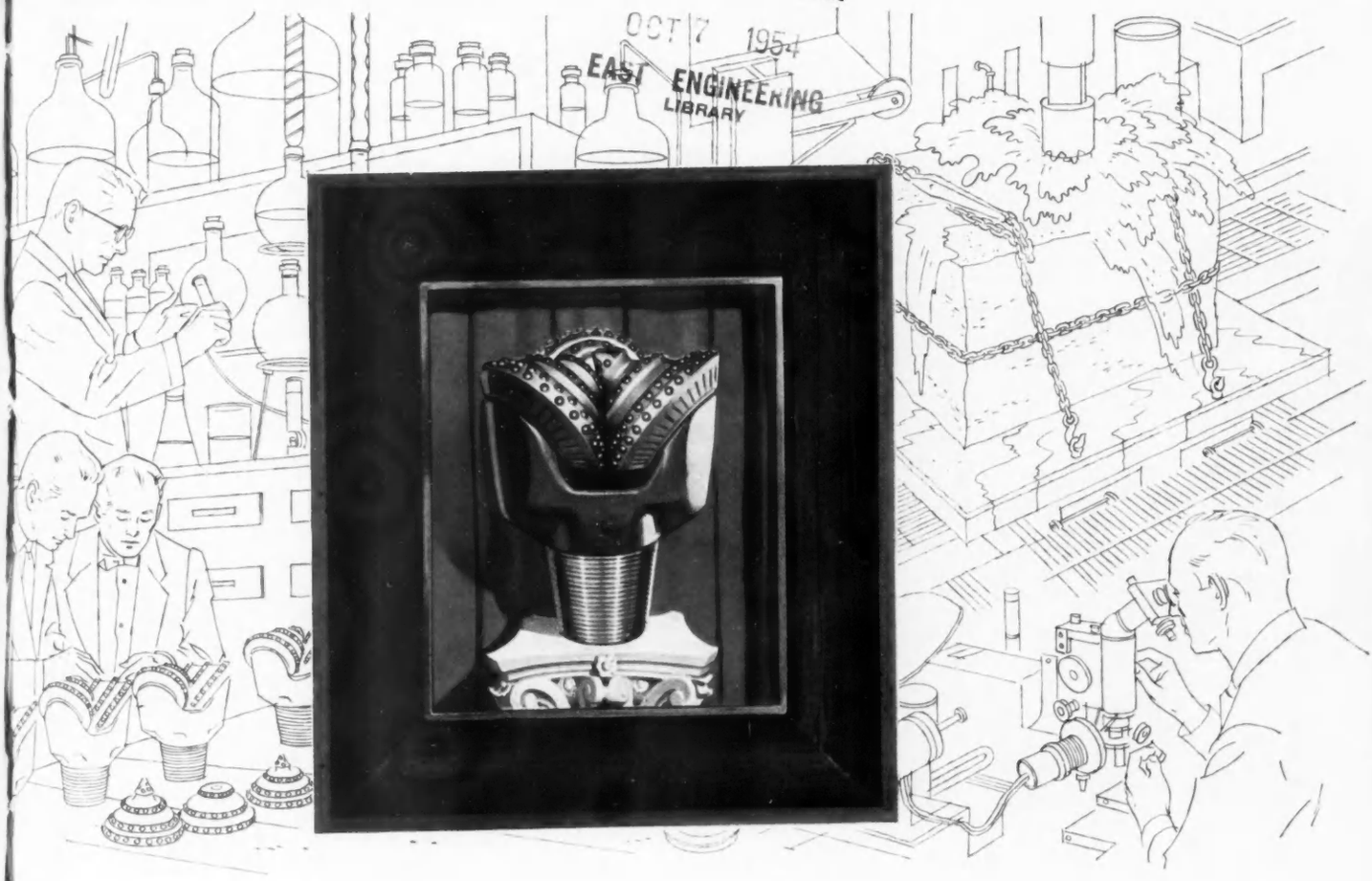

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Progress in the industry has been speeded by those who have sought new ways to improve drilling tools and equipment . . . and who have resisted the temptation to copy the works of others.

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Select Cement to Fit the Job!

WORLD OIL

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Vol. 139, No. 5

October, 1954

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a quick look at WORLD OIL THIS MONTH

BUSY OIL MEN: To help you put first things first, scan these time-saving digests on this and the following pages, checking ☑ those you want to read first.

CURRENT OUTLOOK ARTICLES

☐ **Drilling of more wells and footage although using fewer rigs** is the result of contractors meeting intensified rivalry for business and lower prices with substantially higher penetration. Average rig now drills 3700 feet monthly compared with 2000 feet in 1947. Survey demonstrates competitive nature of drilling contract business, revealing a large number of firms, the majority of them small, and no one firm large enough to appreciably influence prices. Turn to Page 79. Keen Competition Abets Faster Drilling ... Warren L. Baker

☐ **Better trained men and improved drilling techniques** are the answers to the contractors' need for faster penetration rates to offset high costs.

Turn the Page ➧

THIS MONTH . . .

Expanded industry-wide programs are required. Turn to **Page 81** and learn what the industry is doing and can do to achieve desired results. **Research and Crew Training Can Cut Drilling Costs**....**A. W. Thompson**

☐ **Considerable progress has been made** in design, construction and application of automatic computing equipment. See **Page 84** for a detailed summary of how these electronic computers are helping the oil industry. **What Electronic Computers Can Do for the Oil Industry**....**Paul Fullerton and Eugene Usdin**

☐ **Under the sea goes a doughty band of geologists** to seek out clues to ancient oil-bearing formations. Aqualung diving techniques developed for military purposes during World War II were put to industrial use for the first time by the four geologists and two geological technicians who have pioneered this new method of oil research. **Skin-Diving Oil Sleuths Search Ocean Bed**.....**Page 95**

EXPLORATION ARTICLES

☐ **Here's a new Kansas pool** that may mean more reef-like fields are in the offing. The Novinger pool is a "reef-like" limestone reservoir discovered in 1951 in the portion of the Anadarko Basin known as the Hugoton Embayment. The field and its peculiar features are described in an article beginning on **Page 113.** Study and understanding of the variations can enable the geologist and operator to find more oil in Western Kansas. **New Kansas Pool May Mean More Reef-Like Fields**.....**Charles A. Renfroe**

☐ **Oil prospecting activity is due to increase** in the northern half of Arkansas. Development of important gas production has stimulated leasing and wildcat drilling in Arkansas Valley. Development logically will spread out into the adjacent geologic units including the Mississippi Embayment. The conclusion of a two-part article. **See Page 117. Oil and More Gas Promised in Northern Arkansas**.....**B. J. Scull**

☐ **The precarious position** of industrial leadership at the big business level has been described in a new book by A. D. H. Kaplan, *Big Enterprise in a Competitive System*. Kaplan finds that to be big does not necessarily guarantee prosperity. Other observations of his seven-year study of big business are reviewed in **The Changing Panorama**.....**Page 96**

☐ **The oil industry's economic outlook** is in the hands of the refiners during the next six months. Unless refiners carry on a determined fight, U. S. gasoline inventories will be far too excessive by next spring, according to the **Report from the Observatory.** Refiners must make enough distillate fuel oil without making too much gasoline. Failure to reduce runs to stills has made it impossible to reduce the gasoline surplus sufficiently. **Gasoline Yields Must Be Cut**.....**Page 100**

DRILLING CONTRACTOR ARTICLES

☐ **Money-saving ideas.** Here is a collection of practical ideas that have saved money for drilling contractors. Some of the ideas are not practical for all operations, but it's a good bet that you'll be interested in 35 ideas that will provide food for thought. Turn to **Page 133. Here Are 35 Money-Saving Ideas**.....**Philip L. McLaughlin**

☐ **What are the keys to successful competitive drilling?** Analyze your drilling phases from rig operation through drilling techniques and apply these fundamentals to your everyday operations. The drilling industry can save $100 million this year by cutting three days drilling time off each of the 50,000 wells to be drilled. Turn to **Page 146** for Part 1 of a series of articles dedicated to saving time and money for the contractor and producing company. **Keys to Successful Competitive Drilling**....**Roy A. Bobo, Robert S. Hoch and George S. Ormsby**

☐ **How to run and handle drill pipe** is explained in an article designed to aid the contractor by getting across some points that encourage good operating practices. Written by one of the industry's leading training specialists, the article was adapted from a moving picture sponsored by the API, AAODC and the University of Texas. See **Page 152. How to Run and Handle Drill Pipe**.....**Richard L. Dailey**

☐ **Questions on technology and rig operation** which confront the contractor are discussed in an article on **Page 162** and ideas to help the contractor reduce his maintenance and drilling costs are presented. The problems discussed include:

- How to prevent deterioration of rubber when using emulsion muds.
- What does a piping diagram for compounding of pumps look like?
- What's the value of supercharging a slush pump?
- Why use stress relief grooves on drill collar threads?
- Where should stabilizers be used in drill collar string?
- What wash pipe sizes are available?
- How can electrical equipment be stored?

Some Questions and Answers on Practical Drilling Problems.....**Philip L. McLaughlin**

WORLD OIL, published every month except semi-monthly in February and August. Entered as THE OIL WEEKLY as second class mail matter December 23, 1916, at postoffice at Houston, Texas, under the act of March 3, 1879.

THIS MONTH . . .

☐ **Nothing mechanical** that can run without some attention has been invented. This goes for multi-cylinder gas engines, whether on drilling rigs or on a producing lease. A little preventive maintenance know-how will keep engines running smoothly and economically. On **Page 172** is an article telling how to keep these prime movers in good running condition for longer life and greater economy. **Proper Maintenance of Drilling Engines** . . . . . **Anthony Gibbon**

☐ **Drilling rig storage problems** involve some important factors which must be considered in storing rig equipment and tools conveniently. Close attention to these problems may, and often does, become as important as the technique used in drilling in its effect on over-all costs. **Solving Rig Storage Problems**. **Page 182**

☐ **Back in 1919** in the early days of the oil fields, rivalry between the cable tool and the rotary man was rampant and sometimes caused brawls. Out of this came many amusing events. An incident involving a human fishing tool has been culled from the pages of *The Oil Weekly* and retold here. **Out of the Driller's Past** . . . . . **Page 186**

☐ **Diesel engines** have more severe lubricant requirements than do gasoline engines and both have benefited from the recent use of chemical additives to oils. Lubricants available today are far superior to those used 15 years ago. Additives present one route to better lubrication, but this isn't the final answer. The way is clear for further improvement. See **Page 186** for a discussion of this subject. **Diesel Lubricants Are Getting Better.** . . . . . **Robert A. Pejeau**

PRODUCTION ARTICLES

☐ **Design features and cost comparisons of higher voltages** for lease electrification indicate considerable savings for the 762- and 880-volt systems. Discussion of the main items making up the distribution systems, with illustrations, is presented in an article beginning on **Page 203.** Sample calculations show advantages of the 880-volt system over the 440-volt system. Complete analyses of two separate electrification systems are compared for various voltage ratings. Cost data are included. **Higher Voltage Distribution Systems Designed for Economy** . . . . . **B. L. Moore**

☐ **How do fractures affect recoveries in thin reservoirs?** The second in a series of articles on the subject deals with the estimated performance of a line drive pattern in water-flooding and gas cycling. Conclusions reached include the fact that fracturing permits larger areas to be swept in a much shorter time. For details turn to **Page 214. Water-Flooding and Gas Cycling Affected by Horizontal Fractures in Thin Reservoirs** . . . . . **Dr. Paul B. Crawford**

☐ **To water-flood or not to flood** is a proposition that is now facing or shortly will face many operators who own small leases. How can you tell, and what can you do to determine the answer? Two authorities on water-flooding give some down-to-earth information on the subject, what is required to make an evaluation and how it is done. Beginning on **Page 220** three typical calculations are presented in **How to Evaluate the Water-Flood Possibilities of a Lease** . . . **C. H. Keplinger and J. M. Wanenmacher**

☐ **How to stop a landslide from ruining an oil field** has been the No. 1 question confronting operators in the big Ventura Avenue oil field of California. Although it was not completely stopped, it was controlled by some rather unique methods. Big problem was to drain water from the slide itself and keep water from penetrating into the ground. How this was done is told briefly in **How Landslide Was Controlled at Ventura** . . . . . **Page 226**

☐ **Accuracy of high-pressure gas measurement has been increased** in field operations by the application of several simple ideas based on engineering fundamentals. For the gas measurement engineer or management, here are the answers to such problems as: flow line installations, intermittent flow (gas lift) and pulsations, such as produced by compressors. See **Page 228** for details of the problems and their solutions. **Accuracy Increased in High-Pressure Gas Measurement** . . . . . **W. A. Rock**

☐ **Expansion and centralization of production and exploration research** has been culminated by Humble Oil & Refining Company with the dedication of a new $3 million research center in Houston. For picture and story see . . . **Humble Dedicates New Houston Research Center** . . . . . **Page 242**

INTERNATIONAL ARTICLES

☐ **The recent discovery of oil at Parentis** by Esso Standard Francaise, the first privately-owned oil company to find commercial production in France, created a sensation in France. Parentis 1, with a yield of 3500 barrels of oil daily, is the biggest producer in France as well as Western Europe. Of continuing high interest is development work which is progressing, despite abandonment of Well 2 as dry. Well 3 has just been brought in to mark the field as the most important one to date in Western Europe. For details see **Parentis Is Now West Europe's No. 1 Field.** . . . . . **Page 257**

Turn the Page

THIS MONTH . . .

☐ **In Australia's oil future,** the area south of the Mount Fenton fault looms large. It may offer more possibilities than the Fitzrey Basin, itself an object of considerable interest, as explained on **Page 266.** **An Expert Appraises Australian Oil Possibilities (Part 2)** ..... **Werner F. Schneeberger**

☐ **Growing Soviet bloc oil exports,** which may pass the 1932 record high of 123,000 barrels a day, could one day create an artificial surplus sufficiently large to threaten market stability in some Western countries. Already, the Russians—through intricate war reparation demands—have forced several nations to import Communist oil in barter pacts. For what that can do to the free world, turn to **Page 260** to an article which also lists several possible methods for combating this phase of the ultimate Soviet objective of destroying the free world. **What Do Mounting Soviet Exports Mean?** ..... **Veritas**

☐ **Even in the Kuwait desert, 160 degrees is hot.** And skidding a heavy drilling rig and equipment—205 tons in all—99 miles is a big job in any country. But put them together and complete the job in 40 hours, and you have a **Record Run in the Sun** ..... **Page 258**

SPECIAL ARTICLE

☐ **Permian preview.** A Texas-sized bean pot will be on hand to cook hundreds of pounds of beans for the more than 150,000 expected at the Permian Basin Oil Show in Odessa, Texas, Oct. 14-17. For more about the show, read **Permian Basin Oil Show Ready for Oct. 14-17 Run** ..... **Page 274**

NEXT MONTH . . .

Remote automatic production controls . . .

for inaccessible locations such as the one above are the proving grounds for operating offshore leases from central offices inland. In next month's WORLD OIL you'll find a complete description of Gulf Refining Company's new remote control system for its Timbalier Bay field fringing the Louisiana coast line.

Within the field itself is located complete automatic controls which act as watchdogs when pumps cannot get to the wells because of stormy weather.

Photographs and diagrams will help tell the story of this important engineering achievement in next month's Production Section.

A highlight of your big WORLD OIL next month

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PETROLEUM REFINER and **THE REFINERY CATALOG** for the refining-natural gasoline-petrochemical industry.
PIPE LINE INDUSTRY for the oil and gas pipe line industry.

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Looking Ahead . . .

. . . **Industry is expecting** new onslaughts on depletion allowance when Congress next convenes. Typical of congressmen who are waging running fights on allowance is Rep. Wayne Hays of Ohio, who got in a parting shot in an article in post-session Congressional record. ". . . law will have to be revised to prevent . . . abuse of power by Texas oil millionaires," said he. Another possible attack may result from depletion study being made by Treasury Department. Treasury Secretary Humphrey has refused to take stand on whether allowance should be reduced, but noted earlier that cut would increase revenues.

. . . **Five major companies** are in a race to find petroleum in Turkey. Others may join the competition soon if they can obtain exploration permits under the newly-enacted Turkish petroleum law. The major competitors are Standard Oil Company (N. J.), the Royal Dutch Shell Group, Socony-Vacuum Oil Company, California Texas Oil Company and the British-controlled Kern Oil Company of California. Companies discovering oil will be granted 40-year exploration leases, renewable for 25 years. Net profits, if any, must be split with the Turkish government on a 50-50 basis.

. . . **Federal income tax** forms will go into the mails around December 26, a month later than usual. Mailing date change is partly due to alterations in the tax law, partly because so many forms have been lost by taxpayers.

. . . **Census Bureau's** 1955 survey will include tabulations on all aspects of oil industry. Data will include output, employment, payrolls, fuel and power consumption. Survey will be first in this field since 1939.

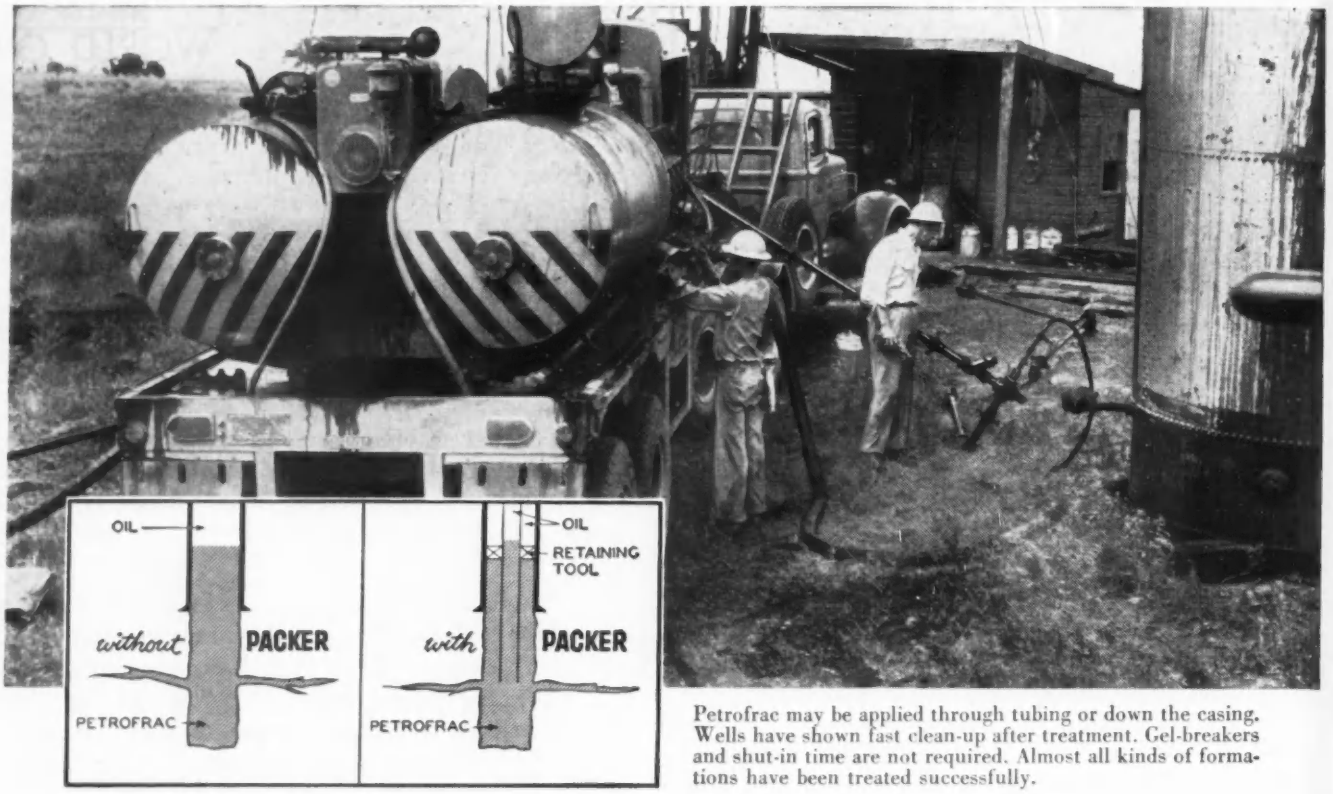
. . . **Business spending** on plants and equipment in last quarter of 1954 will drop to an annual rate of $25.96 billion, it is predicted by Commerce Department and Securities and Exchange Commission. That would mean a decline of $800 million from the third-quarter rate and $2.6 billion below outlay in fourth quarter of 1953.

. . . **All-out production** within six months is hoped for by Iran, now that the oil dispute has ended. A ten-man group of oil experts representing the American, British, Dutch, and French consortium firms which brought about the pact, are now in Abadan to push production plans.

. . . **A new technique** will be used this fall to exploit oil sands along Athabaska River in Alberta. New method will differ from previously used steam, hot water separation, fluidized processing and direct distillation of bituminous sand. New unit, designed by a Calgary building contractor, will be put in operation by Can-Amera Oil Sands Development, Ltd., of Calgary.

. . . **Look for a Congressional fight** early next year over the oil and gas under millions of acres of federal lands in 11 Western states. Issue will center on legislation to (1) transfer to the Western states all minerals and mineral rights under public lands for the support of public schools; and (2) give the owners of surface rights, where the government owns the mineral rights, one percent of oil and gas royalties. Bill with these provisions was introduced just before Congress adjourned by Rep. Frank A. Barrett of Wyoming. He will re-introduce the measure in new Congress and press for hearings.

. . . **Test in 97 feet** of water, deeper by 30 feet than any previously projected in the Gulf of Mexico, will be drilled this fall by CATC (Continental Oil Company, Tide Water Associated Oil Company, Cities Service Oil Company and The Atlantic Refining Company). Group has contracted with J. Ray McDermott & Company of Harvey, La., to build a stationary platform 220 by 106 feet, with deck 50 feet above water.



Petrofrac may be applied through tubing or down the casing. Wells have shown fast clean-up after treatment. Gel-breakers and shut-in time are not required. Almost all kinds of formations have been treated successfully.

PETROFRAC—NEW FRACTURING SERVICE

BOOSTED PRODUCTION 696 BOPD

DOWELL fracturing method makes use of operator's lease crude oil . . . can be tailor-made to suit well conditions

Here's a new Dowell fracturing service designed to increase production from oil and gas wells. It's Petrofrac* —a treatment that uses graded sand and your own lease crude oil. The oil is thickened with a special chemical agent to give it enough body to suspend and carry the sand into the formation.

For proof of its effectiveness, look at this actual case history: An old well was plugged back and perforated opposite a sandstone formation. The well swabbed 24 BOPD. Then Petrofrac jumped production to 720 BOPD, flowing. After a period of flush production, this well leveled off at 300 BOPD, pumping and flowing.

Kerosene, diesel fuel or distillate may be used when lease crude is not available or suitable. As in other Dowell fracturing services, sand may be pumped into the formation in batches—a fine-grained sand followed by a coarse-grained sand.** This is designed to give larger fractures and better fluid drainage.

For more information on Petrofrac or other Dowell services—such as acidizing, perforating, Electric Pilot—call your nearest Dowell station today! Or write directly to Dept. J-13, DOWELL INCORPORATED, TULSA 1, OKLAHOMA.

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Oil Progress Week Important to All

The American petroleum industry will celebrate Oil Progress Week October 10 to 16. Although this is the seventh annual Oil Progress Week, it is just as important as any of the preceding observances.

Much has been accomplished since the industry organized a widespread public relations program with the creation in 1947 of the Oil Industry Information Committee (OIIC), sponsored by the American Petroleum Institute. However, much remains to be done. Too many people still have too many misconceptions about the oil business. This is not surprising, as public information programs of this kind must be continuing, long-range undertakings. Education always must be a never ending effort.

•

The purpose of Oil Progress Week is to give the American people a better understanding of what the industry does and how it does it. The overall theme for the 1954 observance is oil competition and how this competition serves American consumers.

Thousands of oil men will participate in the many events. Hundreds of speeches will be made at business and civic luncheons and other gatherings. In addition, there will be special radio and television shows, exhibits, displays, open houses, parades and special editions of newspapers.

•

Everyone in the oil business should get behind this program. This is the only way to make it really effective. The responsibility does not belong just to members of the OIIC, nor to company officials and public relations men. It is a responsibility of all who believe in the American way of life.

It is easy to participate in the industry's public relations program. Pamphlets, booklets and other special materials prepared by OIIC are readily available. They provide sufficient background data on the progress, operating nature and achievements of the industry to enable anyone to make a speech or intelligently discuss how oil competition serves the American public.

Something like 1¾ million people are employed in the oil industry of the U. S. What they say to their families, friends and acquaintances carries greater weight than anything they see in print or hear over the radio. So every oil man and woman, from bigwig to stenographer and clerk, should start talking shop for all he or she is worth.

Therefore, Oil Progress Week also affords oil companies a golden opportunity to better educate their own employes. Distribution of some of the OIIC material will make good-will ambassadors of many employes.

•

The job before American business, of which oil is an important segment, is to inform the American people as to just why the American competitive economic business freedom is important to this country. As more people gain a better understanding of the oil industry, their appreciation of the significant part it plays in their lives will grow.

This will enable the public to understand how and why a privately-owned, competitive and enterprising petroleum business best serves the American interest. Understanding this, the public will be in a better attitude and position to defend the economic freedom which has made America great.

Oil has a wonderful story to tell. Everyone in the oil business should be proud to tell it at every opportunity.

Warren L. Baker

Keen Competition Abets Faster Drilling

Drilling contractors meet increased rivalry for business and lower prices with higher penetration rates, giving U. S. ability to drill far more wells and footage while using fewer rigs.

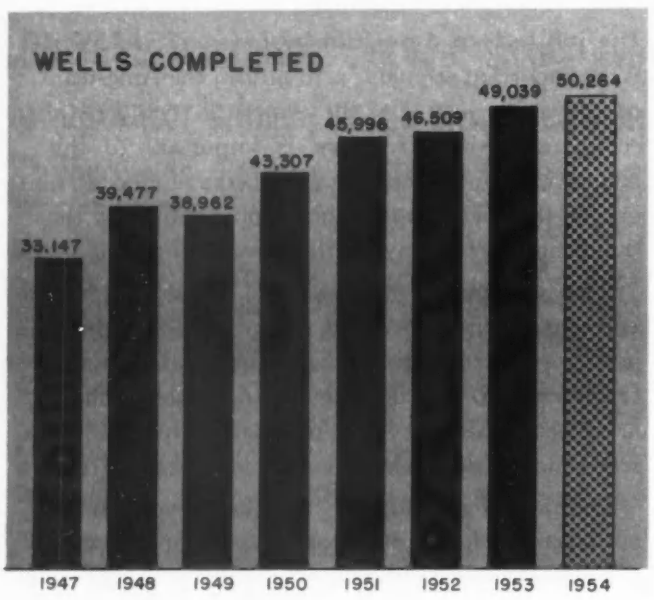
By WARREN L. BAKER, Editorial Director, WORLD OIL

THE ABILITY to drill far more wells and footage while employing fewer rigs is an outstanding recent accomplishment of the United States petroleum industry. This is possible because faster penetration rates have greatly increased the wells and footage drilled per rig.

Drilling contractors are largely responsible for this achievement. They do most of the drilling, accounting for an estimated 92 percent of the nation's wells and footage.

While many factors have contributed to the ability to make hole faster, extreme competition in the contract drilling business has been a truly major influence. Few businesses have so much competition. Despite the growth in wells and footage, the use of fewer rigs has increased rivalry for contracts to the extent drilling prices have slumped. Faster drilling rates have been the overall result.

Basic characteristics of contract drilling make it a highly competitive business. These are clearly pointed out by the results of a recent WORLD OIL survey. A large number of firms are in the business, the majority of them small. No one firm is large enough to appreciably influence prices or other phases.

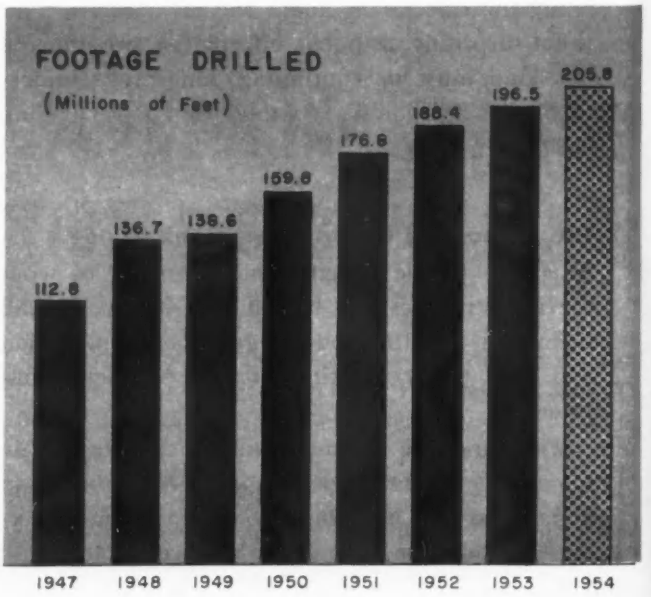


Far More Wells Being Drilled . . .

Contractors do much more business today than ever before. Unusually sharp postwar gains have boosted U. S. drilling rates far above earlier years. Current levels are 50 percent larger than in early postwar years. Contractors also do a higher portion of the drilling.

A total of slightly more than 50,000 wells is expected to be drilled in the U. S. during 1954. Only 49,039 wells were completed in 1953, but 46,509 during 1952, and 45,996 in 1951. Each represented a new all-time high.

These volumes have been reached in recent years only. Less than 40,000 wells were drilled per year prior to 1950, and an annual average of less than 32,000 wells were completed during the period 1937-1941.



Sharp Gain in Footage Drilled . . .

Growth in well completion rates only partially tells the story of expanded U. S. drilling. The amount of footage drilled has increased much more rapidly than the number of wells completed due to deeper depths.

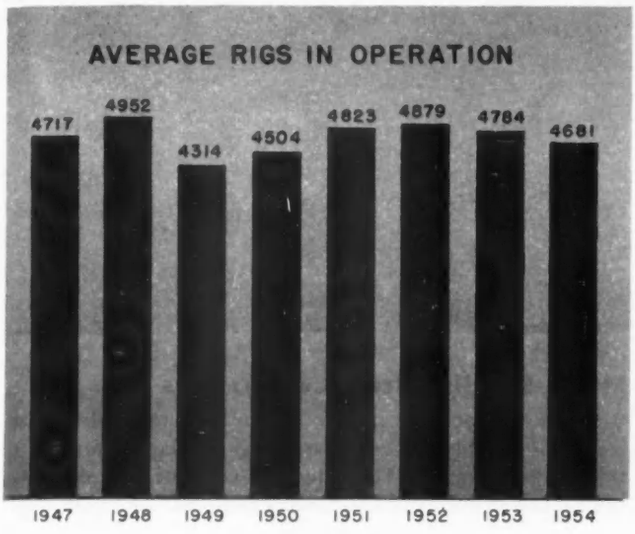
The industry is expected to drill about 206 million feet of hole in 1954. The previous peak was 196.5 million feet in 1953. As recently as 1947, only 112.8 million feet of hole were drilled.

The current rate is double prewar volumes. Before the war, it was customary for the industry to drill approximately 95 million feet yearly. In only one prewar year did footage reach 100 million.

The sharper gain in footage is the result of a growing portion of the wells completed being located in

deeper producing areas. Average well depths for the nation have exceeded 4000 feet during the last three years, compared with only 3400 feet in 1947 and 1948.

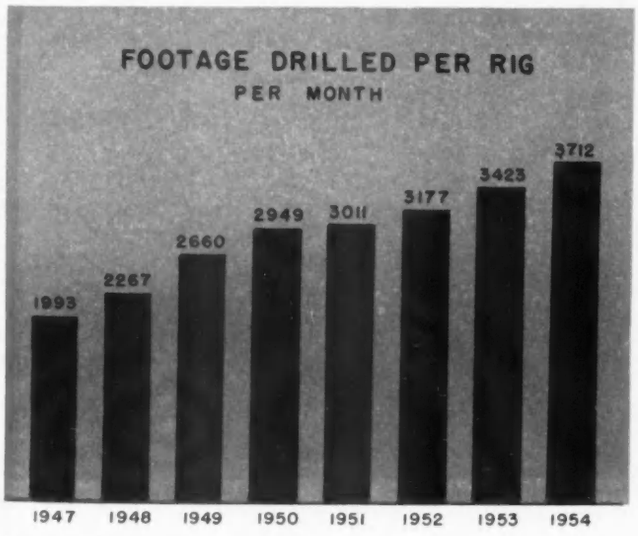
On the basis of doing but 81 percent of the drilling, contractors drilled 91.4 million feet of hole in 1947. In accounting for an estimated 92 percent of the drilling, contractors will drill 189.5 million feet of hole in 1954.



Fewer Rigs Are Being Used . . .

Despite greatly expanded drilling rates, fewer rigs are being used.

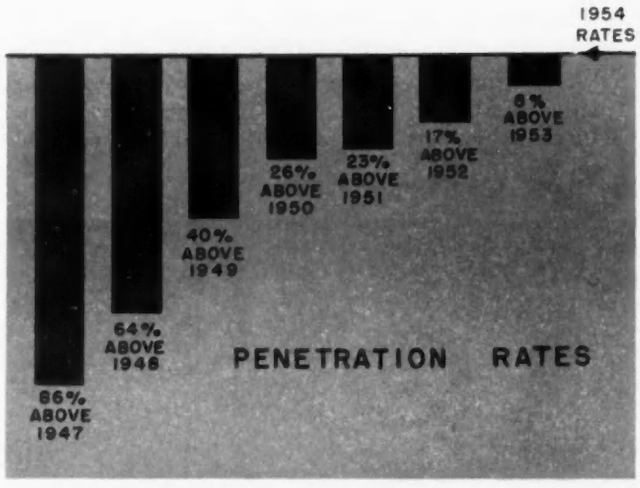
An average of but 4681 rigs (rotary and cable) were in operation during the first seven months of 1954. In contrast, there were an average of 4784 rigs operated in 1953, and 4879 during 1952. Rigs were at a peak in 1948, averaging 4952 in drilling only 39,477 wells and 136.7 million feet of hole.



More Footage Drilled Per Rig . . .

The industry is able to drill more wells and footage with fewer rigs because of faster penetration rates. Much more footage now is being drilled in a rig month than in previous years.

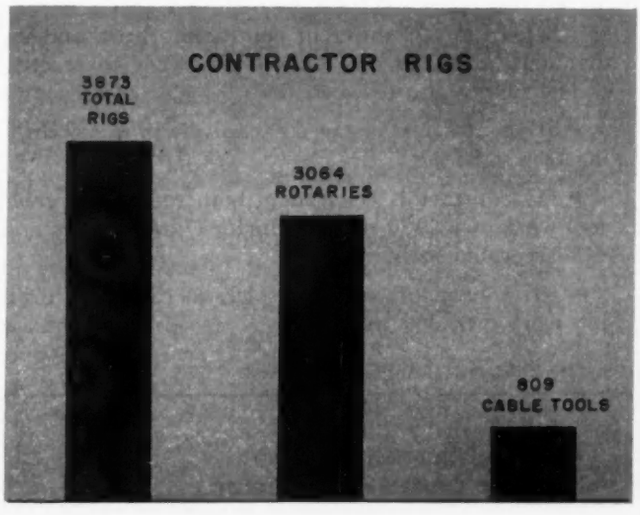
In 1947, an average of 1994 feet was drilled per month per rig in operation. This has increased sharply, until 3423 feet was drilled per month per rig in 1953, and 3712 feet a month per rig during 1954.



Much Faster Penetration Rates . . .

Drilling of 3712 feet of hole per month per rig in operation is a substantial growth in penetration rates. It constitutes an increase of 8 percent over 1953; 17 percent over 1952; 23 percent since 1951; 64 percent above 1948 and 86 percent higher than 1947 rates.

Competition is largely responsible for faster penetration rates. In the rivalry for drilling contracts, footage prices have dropped. Hence, contractors must keep their costs down by utilizing better equipment, more efficient crews and greater know-how to make faster hole.



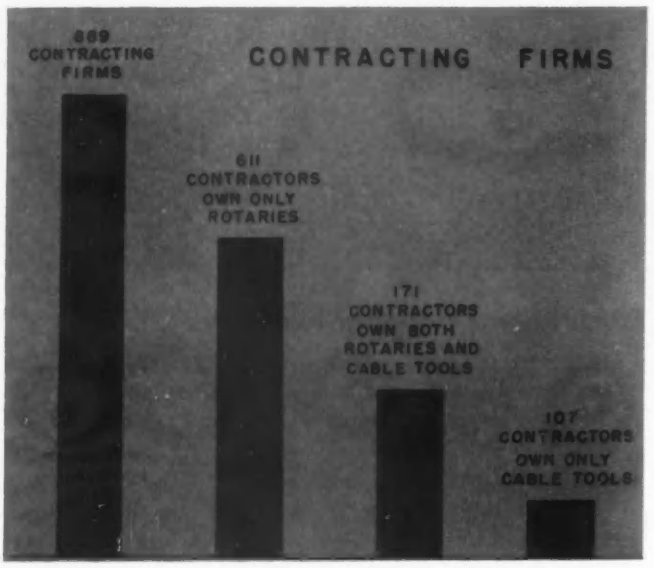
Contractors Own Most of Rigs . . .

The oil industry is able to drill 50,000 wells and more than 200 million feet of hole annually in the U. S. because of a large contract drilling business. Contractors own most of the rigs and do most of the drilling work.

A recent survey by World Oil was able to determine the ownership of 3873 contractor-owned rigs in the U. S. This indicates that U. S. contractors own between 4000 and 4250 rigs. The figure is exclusive of an estimated 800 rigs owned by producing companies which do not engage in contract work, but use these rigs to drill a part of their wells. The figure also is

exclusive of service and workover rigs, which sometimes engage in contract drilling work.

A vast majority of the rigs owned by contractors is of the rotary type. Of the 3873 rigs covered by WORLD OIL's survey, 3064 were rotary rigs and 809 were cable tool rigs.


889 CONTRACTING FIRMS
CONTRACTING FIRMS
611 CONTRACTORS OWN ONLY ROTARIES
171 CONTRACTORS OWN BOTH ROTARIES AND CABLE TOOLS
107 CONTRACTORS OWN ONLY CABLE TOOLS

Large Number of Contractors . . .

The highly competitive nature of the contract drilling business is shown by the existence of a large number of contractors. The survey showed that the 3873 rigs belong to 889 different contracting firms and individuals, an average of only 4⅓ rigs per contractor.

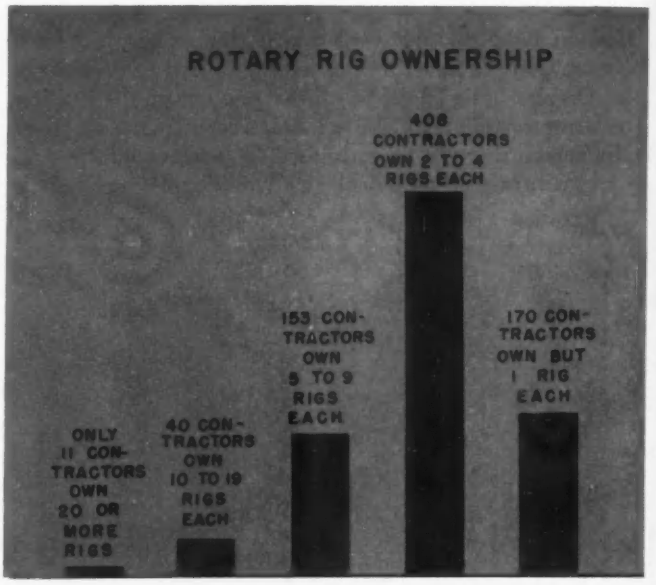
The survey also revealed that:

- 617 contractors engaged exclusively in rotary drilling own 2387 rigs.
- 171 contractors engaged in both rotary and cable tool work own 1120 rigs, of which 677 are rotaries and 443 are cable tools.
- 107 contractors engaged solely in cable tool drilling work own 366 rigs.

For 70 pages of special interest to . . .

Drilling Contractors

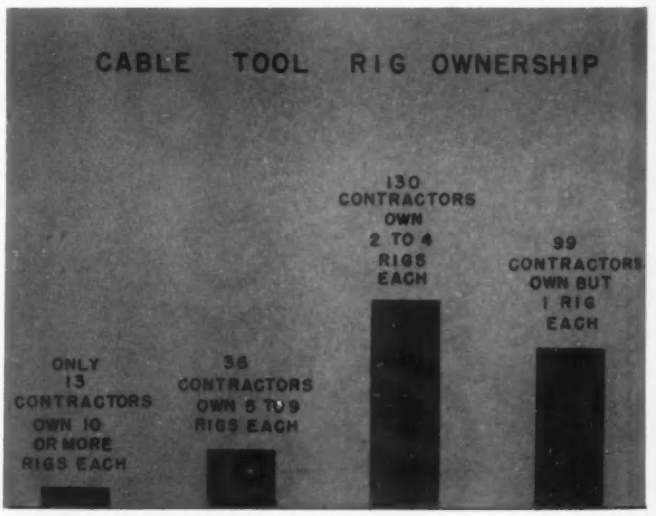
turn to Pages 131-200 of this issue


ROTARY RIG OWNERSHIP
ONLY 11 CONTRACTORS OWN 20 OR MORE RIGS
40 CONTRACTORS OWN 10 TO 19 RIGS EACH
153 CONTRACTORS OWN 5 TO 9 RIGS EACH
408 CONTRACTORS OWN 2 TO 4 RIGS EACH
170 CONTRACTORS OWN BUT 1 RIG EACH

Many Small Rotary Contractors . . .

The competitive nature of the current drilling business is further demonstrated by the large number of small contractors. Three fourths of the 782 contractors who own rotary rigs (including 171 who also own cable tool rigs) own less than 5 rotaries each. More than half of the rotary rig contractors own from 2 to 4 rotary rigs each.

The rig ownership survey also revealed that only 11 contractors own more than 20 rotaries, 40 own from 10 to 18 rigs each and 153 contractors own between 4 and 9 rigs apiece. Largest ownership group is the 408 contractors owning 2 to 4 rigs each, while 170 contractors own only 1 rotary rig each.


CABLE TOOL RIG OWNERSHIP
ONLY 13 CONTRACTORS OWN 10 OR MORE RIGS EACH
36 CONTRACTORS OWN 5 TO 9 RIGS EACH
130 CONTRACTORS OWN 2 TO 4 RIGS EACH
99 CONTRACTORS OWN BUT 1 RIG EACH

Cable Tools in Many Hands . . .

Cable tool rigs, like rotary rigs, are mostly in the hands of small contractors.

The survey showed only 13 contractors own more than 10 rigs, the largest single firm owning 20 cable tool rigs. There are 36 contractors who own 5 to 9 rigs each. Biggest ownership group again was the 130 contractors who own 2 to 4 rigs apiece, with 99 owning but 1 rig each. —**The End**

Research, Crew Training Can Cut Drilling Costs

Better trained men and improved techniques will answer contractor needs for faster penetration rates to offset high costs. Expanded industry-wide programs are required.

By A. W. THOMPSON, Chairman, Research and Education Committee, American Association of Oilwell Drilling Contractors, and President, A. W. Thompson, Inc., Houston

HIGH DRILLING COSTS make it necessary for contractors to adopt any and all methods that will reduce the expense of drilling wells. Better trained men, using the latest drilling techniques and the best of equipment is the answer. Hence, contractors must expand their drilling research and employe training efforts.

The nature of the drilling business dictates that research and crew training programs be on an industry-wide basis rather than a company basis. Contracting firms are too small to engage in research and personnel training on any extensive company scale. Because of the short duration of drilling contracts and the frequency of moving rigs from one area to another, drilling manpower is highly transient, causing the industry to operate from an over-all common labor pool. Consequently, drilling contractors must look to their association for needed employe training courses and research studies.

Members of the American Association of Oilwell Drilling Contractors have recognized these needs, and in recent years have steadily expanded the association's research and employe training work.

From 1946 through 1953, more than 20,400 men have taken the association's training courses. Many of these men have taken the training on their own time. It has cost the state training departments and the contracting industry approximately $400,000 over a period of eight years. A great deal of good has been accomplished by this work. But to be fully effective, the program must be expanded greatly.

Likewise, the association has realized the value of research work on outstanding operating problems. However, this work also needs to be enlarged to cover additional phases.

It is the hope of the Research and Education Committee of the association that more funds be made available for this work. It would be desirable to have at least $400,000 per year for such work. This expenditure would not impose a hardship on any individual contractor. If each contractor would contribute only ¼ cent per foot of hole drilled per year, the fund would amount to more than the money spent during the entire life of the program thus far. With contract drilling now a billion dollar industry, a contribution on the above basis for research and educational work is the minimum requirement if real progress is to be achieved in reducing costs.

Early studies. The first research program of AAODC was put into effect in 1945. The study, under the auspices of Battelle Memorial Institute, Columbus, Ohio, was devoted to the use and care of drill pipe. It was continued over a two-year period. The results have made savings many times over the original cost of the program. This study was financed by interested contractors, most of whom were operating in the Permian Basin.

In 1946 the Research and Education Committee sponsored a 25-hour short course for regular personnel on the control of drilling fluids. A manual was written and a grant made to the University of Texas for expanding the course to all parts of the U. S. John Woodruff, the present assistant director of Petroleum Extension Service for the University of Texas, was assigned to work with the association in developing this program. Woodruff has continued to the present time as consultant to the association, and his advice and assistance in working out the educational programs of the association have been outstanding.

In 1947 a drilling practice course was established at Kilgore College, Kilgore, Texas, for training of high school graduates and ex-G.I.'s as roughnecks in the drilling industry. Insufficient funds forced curtailment of the program in 1953.

In 1948 a series of accident prevention conferences was sponsored. Later, these were turned over to the Safety Committee and now are run as Area Safety Clinics.

Scope broadened. In 1949, in addition to mud schools, a drilling practice course, accident prevention courses and a series of management institutes were organized. Development of the employer unit plan of advisory training was used in West Texas and Oklahoma, and was carried through 1952. During this period, a full-time staff man was added to expand the activities of the committee. An engine school was held in the Odessa, Texas, area in 1949. To equip the drilling engine laboratory, manufacturers and supply men donated $50,000 of new equipment and

paid all installation and transportation costs. This stands out as another tribute of fine cooperation that is so often given our industry by the manufacturing and supply company men who are our associate members. During this period, the training program was extended to the following new areas: Kansas, Michigan, Rocky Mountain and Alberta, Canada.

In 1951 a Primer of Oil Well Drilling was started, and completed in 1952. To date nearly 40,000 copies have been distributed and demand continues from areas all over the world. In 1951 a short course in the care and handling of casing was developed. This course proved to have such wide acceptance the committee co-sponsored two more short courses:

- The Care and Handling of Drill Collars, Drill Pipe and Tool Joints.
- Drilling Fluids.

These last two courses have not been given over a wide area due to the difficulty of finding adequate teaching personnel.

The committee, in cooperation with the API Vocational Training Committee, is working on a series of three supervisory training films to be used with the conference type of training program. One of these films has been completed now, and the other two will be shortly. All the films will be in the Dallas office of the AAODC and available for the use of members.

Mud research program. Last February the Board of Directors authorized the committee to establish a new research program at Battelle Memorial Institute. Object of the program is fundamental research on relationship of drilling fluids on rate of penetration. A lot of research has been done on mud by the operators and the mud companies. However, this will be one of the first attempts to try to find out what effect mud has on penetration rates.

The program is set up on a one-year-basis but probably will be extended over a period of years. The president of the association has appointed a Technical Advisory Committee to work on the program with the Research and Education Committee. This committee is composed of some of the outstanding engineers in the drilling industry. In addition, Hughes Tool Company and Reed Roller Bit Company research departments have offered their services and cooperation to the fullest extent on the project.

Copies of all progress reports from Battelle are given to this advisory committee and to the research departments of the above companies for their advice and criticism. By following this practice it is the hope that the work will be greatly expedited.

New training courses. The Research and Education Committee is now working closely with the API Central, Vocational Training and Supervisory Training Committees. Courses sponsored by the API will be used in AAODC Training Schools and likewise, the API training groups will use AAODC material wherever they can.

At the July directors' meeting at Colorado Springs, Colo., the committee recommended that a school be established for the upgrading of employes of the industry and allied fields. The purpose is to train men that company management thinks can be promoted to better jobs. The school is to be known as School of Drilling Technology and will use the facilities of Odessa College. Two sessions will be held, one starting on Oct. 11, 1954, and the second starting on Feb. 7, 1955. This school is on an experimental basis. Short API and AAODC courses will be taught. It is hoped that results will warrant extension to other areas where there is a large concentration of drilling rigs. Some of the outstanding engineers in the industry will act as instructors in these courses.

Recognizing the need of training for men employed by work-over and well servicing contractors, the committee, again in connection with the Extension Division of the University of Texas, is in the process of publishing a Primer of Well Servicing and Workover. In addition, the association is co-sponsoring six motion picture films showing the different equipment and techniques used in well completions. The pictures will be:

- Electric Logging.
- Radio Activity Logging.
- Perforating.
- Two pictures on Cementing Practices.
- Acidizing.
- Fracturing.

All this material will be used in short courses now being planned for contractor and company personnel. Well servicing and workover contractors have become recognized as an important bracket in the industry, and are trying, with the assistance and cooperating of the oil company engineers and equipment manufacturers, to establish a training program for men in their employ as another step in know-how and efficiency.

It has been a matter of concern over the years of those contractors who have the welfare of the industry at heart, that the drilling business has been unable to attract and hold technical training men. With this in mind, the board of directors authorized the

Table 1

AAODC Training Enrollment Summary

September 1 to September 1 Each Year

YEAR	Mud Schools	Accident Prevention and Field Institutes	Management Institutes	Drilling Engines	Employer Unit Plan of Supervisory Training	Drilling Practices	Handling Casing	Total
1946	642	0	0	0	0	0	0	642
1947	2328	0	0	0	0	0	0	2328
1948	1797	150	0	0	0	0	0	1947
1949	1153	250	487	100	662	68	0	2720
1950	277	0	215	52	2661	89	0	3294
1951	564*	108**	0	0	1506	39	0	2217
1952	244*	0	0	0	108	0	2453	2805
1953	361*	0	0	0	486	0	3680	4527
TOTAL	7366	508	702	152	5423	196	6133	20480

* Combined Mud School enrollment of schools held by University of Texas and Sowela Tech at Lake Charles, La.
** Field Institutes for Supervisors held at Odessa, Texas, and Casper, Wyo.

committee to establish a system of presenting honorariums to professors and instructors in petroleum engineering schools who put forth the most effort in interesting the students to become career men in the industry.

At the Colorado Springs meeting the board authorized the practice be continued again this year and increased the number of honorariums from three to five. This is in line with the thinking of management in other industries that if well trained men are desired, good teachers must be had to train them.

Conclusions. From experience already gained, it can be concluded that research and training programs are logical projects for the drilling contractor association. These programs perform a real and valuable service to the industry. In the drilling industry, where manpower is transient and there exists what amounts to an over-all labor pool, the training job becomes industry-wide rather than company-wide. The approach, therefore, must be industry-wide in scope, and through special programs, made available to all employes of the industry.

The contractor today is producing the lowest cost per foot of hole in the history of the industry. This in spite of increased costs of over 100 percent. This speaks well for the contractors effort, but only the surface has been scratched. Advancements in drilling technology, in know-how and in equipment during the years to come, will enable contractors to drill many wells that today are uneconomical to drill. In the final analysis there is only one way you find oil, and that is to drill for it. Many more and deeper wells will be required in the future to obtain the same amount of oil being produced today.

More and deeper wells cannot be drilled unless costs are reduced. Faster penetration rates are the only way contractors can reduce costs. Better methods and personnel are two factors which promise faster penetration rates. Expanded research programs and educational studies will develop improved methods and more skilled personnel. —**The End**

The Courts Say . . .

in recent insurance cases

Shelton

This column is to inform—not advise. It presents the current trend in legal thinking on insurance cases. The law varies from state to state and its application depends upon the facts of the particular case. Do not attempt to apply it without consulting your attorney.

By Joseph M. Shelton, Attorney at Law, Dallas

That Workman was Entitled to Compensation if a Job Incident Contributes to Cause Incapacity

A DRILLER while bent in a position where his head was below the level of his feet undertook to screw a pressure gauge into a valve. While in this position he suffered a brain hemorrhage and claimed to be permanently and totally disabled. The Trial Jury found for the driller and the Insurance Company appealed on the theory that there was no accidental injury because driller was not subjected to any greater strain than that of his usual activities.

The Court of Appeals affirmed the Trial Court, saying in effect that driller's position with his head lower than his feet together with the effort of placing the gauge were sufficient to produce a strain. They further stated that such a hemorrhage as a result of job exertion entitled employe to compensation even though predisposing factors contributed.

—Traders & General Ins. Co. vs. Rooth
268 S. W. 2nd 539 (Tex. Civ. App.—Waco, 1954)

That Employe was on Personal Mission

EMPLOYE WAS sent by employer to another city to attend a three week training course. While in this other city he was required to attend school Monday through Friday until 4:45 p.m. He was paid his regular salary and expenses while in school. He was free to do as he liked evenings and on the week ends. On a Saturday afternoon he accompanied another student on an automobile ride about the city and was involved in a fatal accident. Employe's wife sought compensation death benefits which were awarded by the Trial Court.

The Supreme Court of Tennessee reversed the case, holding that the duties of the employe did not require him to travel except to the place where the school was held and back and forth between his hotel and school. At the time of the accident the employe was not on any mission in which his employe had the slightest interest.

—Underwood Typewriter Co., et al, vs. Sullivan
265 S. W. 2nd 549 (Tenn. Sup. Ct., 1954)

That Employe Had Not Elected To Sue Third Party

EMPLOYE WAS injured in an automobile accident while in the course of employment. Employe was told by employer that he didn't carry compensation and that employe should sue the automobile driver. The employe followed employer's advice and it was almost a year before he found that employer did, in fact, carry compensation insurance. The employe filed a claim which employer said was barred because the employe had "elected" to sue the third party. The employer's insurance carrier prevailed in the Trial Court.

The Appellate Court ruled that the employe cannot be held to have "elected" to sue third party instead of seeking compensation when he was without knowledge that he had more than one course available. The Court said that while employe had constructive notice that the employer was covered by compensation, it was ineffective in face of the actual notice to the contrary. The employer's advice to the employe constituted "good cause" for his failure to file a claim within the proper time.

—Loveless vs. Texas Employers' Insurance Association
269 S. W. 2nd 454 (Tex. Civ. App.—Austin, 1954)

THESE MACHINES are two of those available to help the oil industry solve many tedious and complicated problems. Eugene Usdin (left), head of the Mathematical Analysis section, Southwestern Computing Service, and Paul Fullerton, partner, both of Tulsa, stand before electronic calculator (left) and printer.

What Electronic Computers Can Do for the Oil Industry

Seismic and reservoir calculations are only two of the many fields within the scope of automatic computing equipment.

By PAUL FULLERTON and EUGENE USDIN
Southwestern Computing Service, Tulsa, Oklahoma

DURING THE PAST two years, amazing progress has been made in the design, construction and application of automatic computing equipment. Availability of these new devices poses a question to oil industry management: How such computing power can be utilized effectively by their companies? Promise is offered in many accounting areas, economic studies, and in the technical computing phases of both the operating departments and the research laboratories.

Machinery available today runs from moderately-priced electromechanical punched card equipment to very expensive automatic high speed electronic calculators. The more modest cost of the former is usually offset by the larger investment in time for the setup and solution of a problem. This is true on up through the levels of the calculator hierarchy so that the lowest unit costs are often achieved on the most expensive machinery.

Happily enough, abilities of larger and faster computers with their demands of capital and staff appear not to be headed exclusively toward the large data handling problems of the very large companies. Existence of computing services places abilities of both staff and machines in the hands of all. Thus, the machine computing field is one that should hold interest for all who have problems—problems of the type suited to present machine reduction.

Types of problems under active consideration for solution on present computing equipment might be placed into four general groups:

- Data handling.
- Data reduction.
- Solution of equations describing theoretical systems.
- Determination of empirical relationships in physical systems.

Multitude of choices. The first might be labeled the bookkeeping group, which may involve accounting transactions or may be concerned with certain engineering data, such as production and injection history of reservoirs. Characteristics of these problems are, primarily, that a multitude of choices must be examined in connection with each item processed. These choices can be made for the computing equipment by coding clerks. Or by machine, if one can narrow the possibilities for any one item and then match these with the correct choice by means of the storage facility of the computer.

In the oil industry many accounting applications of this type have been converted to punched card machinery. There are a number of engineering applications which have not been widely attempted but which become increasingly promising with the new machinery.

For example, if reservoir history were mobilized so that management were able to compare performance, geologic characteristics, physical characteristics, etc., between all pools, including necessary computation to normalize performance of one reservoir with another, this might serve to augment the judgment or "experience" factor which management must depend upon in so many decisions.

Two advantages: Results are available faster and the cost is less

Many engineering operations come under this general heading of data handling. Performance measurements in reservoirs have to be corrected for fluid column, choke size, etc. Well logs have to be corrected for mud salinity, extent of the invaded zone, etc. In fact, almost all field measurements have to be reviewed and factors applied before the information is stored or used. Often, this routine work occupies a fairly good portion of the engineer's time.

These are the types of operations which are easily coded for machine reduction. In an era where engineering manpower is short, it would appear advisable for management to avail itself of the maximum amount of machine data handling that is economically feasible.

Data for interpretation. The second group of problems, data reduction, is concerned with treatment of data for interpretational purposes. Here, the field of exploration offers examples. Experience indicates that the use of punched cards can offer certain advantages in the day-to-day processing of data as well as in the problems of the research laboratory. There appear to be two general types which can be applied practically.

- The complicated type problem wherein fairly involved equations have to be solved.
- The type of problem where accuracy is a prerequisite and either potential rework of the data or large volume exists.

Results from seismograph operations illustrate the presence of both of these factors. In areas where a complicated weathering correction must be applied or where a curved path is used to represent a propagating wave, the first type problem exists. In areas where simpler computing schemes are used but where steep dip calculations are sometimes employed, and also where rework may be necessitated by development of velocity information from well surveys, type two problem is encountered.

Large volume prominently enters the picture in offshore exploration with the seismograph. Extremely large amounts of data are gathered due to the large number of shots per day which can be made in the water. To treat collected data in a manner commensurate with the costs of obtaining it and the stakes involved, an extremely large number of computers are required.

Present machines are offering enough speed in solution that consideration can be given to the use of rather simple computing schemes previously considered economically inadvisable.

In seismic work, resolving most of the data in the field has been considered good practice. This permits the crew chief to determine if he is getting good records and allows him to follow a particular sand from shot to shot. With more complicated computing schemes, a crew has to be enlarged by possibly one additional computer. This would be justified if all of the machinery for revising the exploration program were available within the crew. Often, however, higher headquarters still reviews daily work and advises on the course of action. Thus, it would appear that if the crew maintained only enough computing power to follow the reflections and the data were immediately sent to a central computing system some advantages might accrue. For instance:

- Certain more complicated computational procedures could be utilized where necessary at very little increase in cost, since a machine would be able to handle the output of many crews.
- Accuracy of machine computation would eliminate any discrepancies between individual computers and would eliminate manual errors.
- Results would be available in much shorter time for the examination by the staff analysts to determine future action.
- A saving in money should be achieved in a program of any size.

The picking of the records for a program of this type probably should follow current practice and be done in the field, permitting field crew to maintain field records to assist its operation. Also, since there have been no better means developed than manual picking of the reflections, it would seem best to have the picks made by those most closely associated with the program.

One of the very encouraging things about computers now being made available to the industry is the improvement in their ability to handle a very inclusive general case. Considering that in turning over computations to a machine it has to assume all the judgment of the human computer, one can see how it becomes increasingly important that the machine know its own limitations.

Two of the first considerations are the planning of a solution which is known to be sufficient and the incorporation of adequate checks on machine performance. Then an operator must have adequate tests to throw out all cases whose solution is not planned specifically. Here is where the broad general case is so important. Branching operations as a function of tests made in the calculation will permit the machine to handle all important types of computation.

A number of new areas of investigation for reduction of field data become possible with the computing ability of the machines. For instance, in the field of gravity and magnetics, various smoothing schemes have been in use through the years. Purpose of these methods is to remove conflict in pattern between the large scale "regional" changes and smaller anomalies which indicate local structure.

The methods have included profile smoothing wherein the interpreter imposes his judgment to make the distinction between the regional and the anomaly along a series of profiles, and grid techniques where adjacent measurements are weighted according to their position in order to determine rate of change of measured quantity; this in hope of emphasizing features small with respect to the regional. Both of these techniques can be effectively performed by machines.

However, another approach, utilizing a surface to represent the regional, presents some possibilities for even better presenting the picture. The only limitation here lies in the data. Generally, this approach proposes to fit a smooth surface such as the least square best quadric or cubic surface obtained from the original data to describe the shape of the regional. Then the differences between the computed smooth surface and the

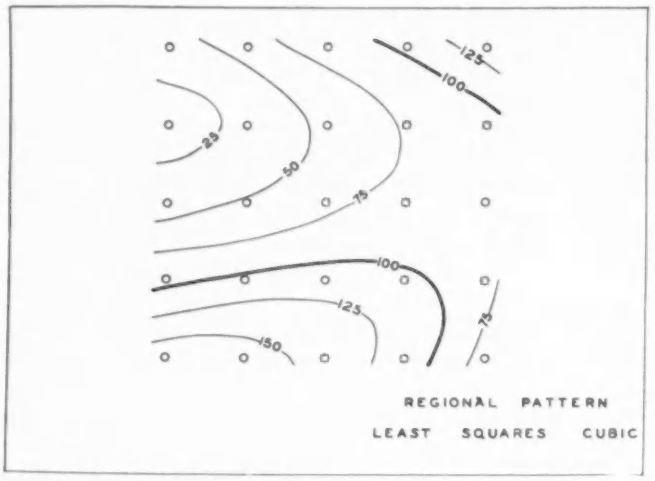


Fig. 1—This is a regional gravity or magnetic pattern which may be described mathematically by a power series of ten terms. The computing machinery can, with this information, calculate the exact value of this regional at any point in area.

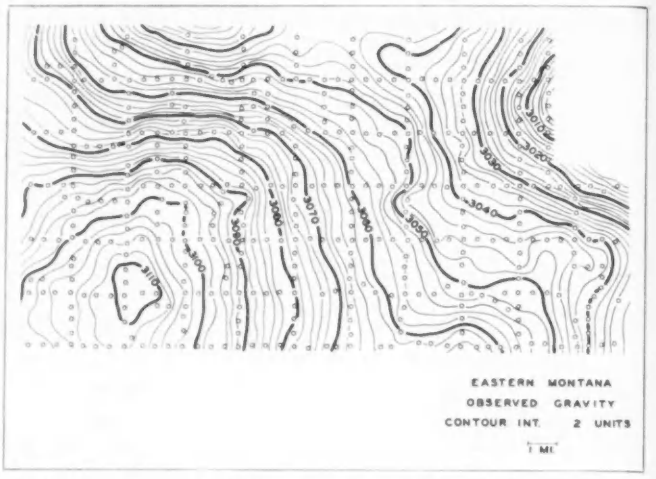


Fig. 2—An actual field gravity survey in Williston Basin.

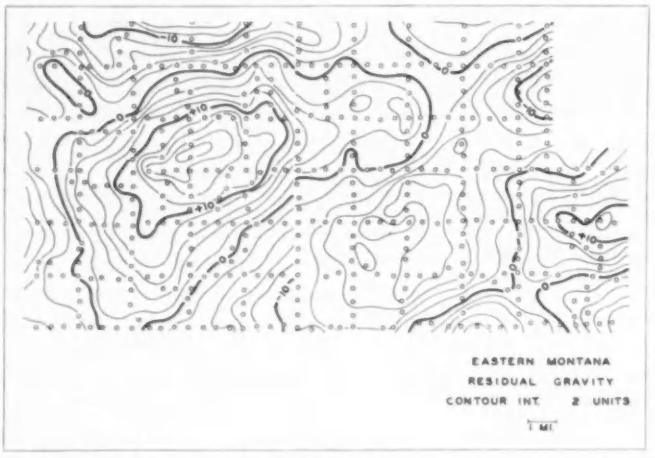


Fig. 3—This is the residual map after the regional has been subtracted from each station by the above method.

Illustrations courtesy T. J. Bevan, geophysicist

observed values yield a residual map. (See Figs. 1, 2 and 3). Derivative maps can also be achieved by utilizing higher order surfaces.

Regardless of interpretation method, several benefits may be seen from the use of punched cards in this work. The first is the mobility which the card presents for correcting the original field data in the light of new elevation factors, etc., with minimum cost and time. Second is ability of machines to perform more complicated operations, such as least square smoothing of data and the solution of 10 and 15 term equations, which one needs to represent a surface.

In data reduction problems of production departments, calculators present a means of achieving more realistic reservoir performance computations. This is true because the machines' speed permits solution of repetitive type calculations at reasonable costs. Here, the repetitive type calculations might include the stepwise solution of differential equations or the type of trial and error which is encountered in the solution of systems of algebraic and transcendental equations.

Common criticism of performance calculations rests largely on inaccurate data with which the reservoir engineer has to work. The machines by offering a reasonable time and cost factor for solution of equations also permit more meaningful solutions to be achieved by extending each solution beyond the given set of data to include a range of the reservoir parameters within the physical possibilities of the case in question. Along with the ability of the machines to present a better picture by merely extending the range of the parameters, using an existing simplified formula, the possibility now exists to mathematically describe a reservoir much more accurately and still achieve solutions at reasonable cost.

In the refinery some of the initial impetus was given to machine data reduction by the new analytical tool, the mass spectrometer. To use the mass spectrometer on a volume basis, it was found that one must successfully solve simultaneous equations arising at each analysis by machine. When dealing with systems involving some 20 unknowns, it is clear that the machine would be of considerable help. Now with the more adequate computers, this problem has become more or less trivial. The door is opening for making much more effective use out of the analyses which can be obtained with this type of equipment to sample and analyze stream flow in a refinery. With the computing power to analyze economic benefits from a variety of courses of action at each stage of operation, automatic control becomes increasingly desirable.

Theoretical equations. This group includes primarily those problems for which there exist theoretical equations. The principal difficulty is in establishing the mechanics of solution. Certain of the fundamental problems of the reservoir engineer come under this heading. Mathematical description of the physical systems encountered are usually partial differential equations which fall in this group. There are no known analytical solutions to these equations, so they must be solved by numerical methods. For most such systems considerable experience is required to adequately formulate the different equations to be employed for solution.

One problem encountered in both production and the refining departments of the oil industry is the solution of the vapor-liquid equilibrium of a multi-component system. Equilibrium constants, or K values, have been used by the industry for reservoir phase behavior, separators and distillation problems. There have been a number of published K values available, as well as those held in trust by various companies.

Among the available values, the Kellogg charts for light hydrocarbons have been outstanding in their ability to include the effect of composition on the individual K values. Work has been reported by Organick and Brown on extending this method to larger systems and heavier hydrocarbons. Another approach is the use of equations of state such as the Benedict equation which becomes practical on modern computing machinery. If one can obtain the coefficients necessary for the state equation defining the system in question, these become a very powerful tool on computing equipment for the solution of distillation columns and problems associated with reservoir phase behavior.

One of the best examples of the value of having accurate equilibrium constants is illustrated by their use in computations necessary for defining the content of a gas condensate reservoir. Design of the attendant gas plant is made on the basis of the product expected through the producing life of the field. If this composition is inaccurately forecast through inadequate K values, expensive redesign may be necessitated in the field's later life.

There are many other areas where difficulty of obtaining numerical solutions has impeded completion of theoretical studies. There is much promise offered in the field of exploration and in the interpretation of the various well logging instruments. Examples of additional power which may be extracted from such tools are illustrated by DeWitte, Frankel and Porter in their work on "Computation of Resistivity Departure Curves," presented at the Fifth Oil Recovery Conference, and DeWitte's paper on "Resistivity Logging in Thin Beds" presented at the 1953 AIMME annual meeting.

Theoretical relationships. This group includes problems which arise in trying to obtain theoretical relationships through analysis of observations. This is a very fundamental phase in both engineering and science. Recently, there has been considerable interest in the development of relationships in the problems of economics.

New "Operational Research" techniques are fundamentally the mathematical formulation and solution of problems heretofore not considered amenable because of the complicated interdependent relationships. Solution to this type of problem is achieved through the analysis of linear systems of inequalities which are used to describe the complete operation. The name "linear programming" has been given to this type of system and the means of solution using techniques such as those developed for gradient methods of solution of simultaneous linear equations. There have been various examples of this type of solution to problems arising in refinery operation, transportation of products and others. The questions which can be answered by linear programming are of the following type:

> "Given the feed to certain refinery units and a range of conditions; what cracking, how much recycling, how much blending should be used to achieve maximum profit with given market prices."

Techniques for adequately handling data in statistical quantities to perform laboratory analyses in operation are beginning to be used. Accurate sampling tools, combined with the methods of statistical analysis, offer much promise for defining optimum operating conditions for individual units in the plant as well as the plant itself. One example is an effort to determine conditions for minimizing the consumption of the sulphuric acid catalyst in an alkylation process.

In this work an attempt was made to determine the relationship between all of the operational variables and the extent or degree with which each influences the overall operation. Such factors as stirring, amount of monomer, temperature, etc., were introduced into the solution with certain hypotheses as to the order of their effect. The statistical measures will give a yardstick for determining how

About the Authors

PAUL FULLERTON is a resident of Tulsa, Okla., and a partner in the Southwestern Computing Service. His present business is directly associated with the computing needs of the oil industry. The company specializes in the application of computing equipment to problems in exploration such as seismic data reduction and to problems in reservoir and process engineering. He is a graduate of the California Institute of Technology, where he majored in applied chemistry. He served in the Air Force during the last war and obtained experience with analog computers utilized in aircraft fire control apparatus.

Before joining Southwestern he was in the Applied Science department of the International Business Machine Corporation. He operated out of Tulsa, which gave him considerable contact with the computing activity within many of the major oil companies in Texas and Oklahoma.

•

EUGENE USDIN, head of the Mathematical Analysis section of the Southwestern Computing Service, is a graduate of Purdue University where he studied mathematics and mechanical engineering. During World War II he served with the Army in the K-25 plant of the Carbide and Carbon Chemicals Corporation. After the war, he was in the Theoretical Analysis department of Carbide in Oak Ridge, and was concerned with gaseous diffusion plant design calculations. Usdin went to Tulsa in 1951 to work for the Stanolind Research Department on seismic problems research. He joined Southwestern Computing Service at its formation in December, 1953.

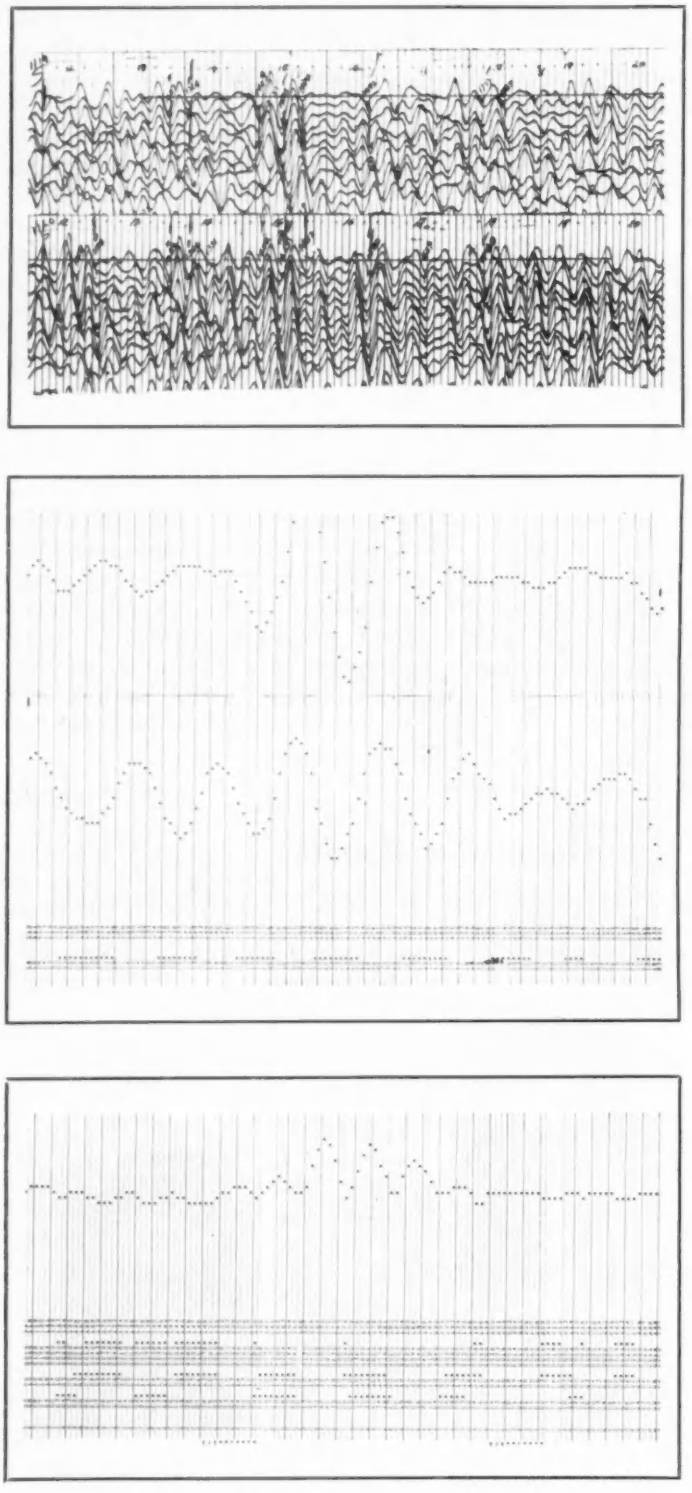


Fig. 4—Top traces from the original seismic records were digitized into the form shown in the center. Curve below shows the result emphasizing the reflection.

Courtesy Sinclair Research Laboratories, Inc., Tulsa

well one has defined the effects. It will tell whether one has accounted for 70 percent of the variability, 90 percent, etc.

Such a study could also be proposed for the optimum exploration program or production program. Here, such factors as appearance of the structure when viewed by the different tools, such as the seismograph, gravity meter and the magnetometer, could be weighed in conjunction with the depth to the formation, the distance of the site from existing gathering systems, accessibility of the site for the initial exploration for the drilling and the maintenance, etc.

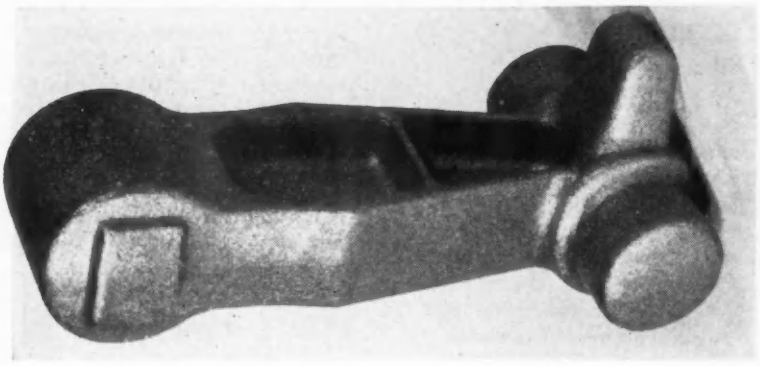
In the field of exploration current availability of magnetic recording equipment is leading to considerable interest in means of best utilizing the reproducible records now obtainable. Some Rieber techniques can now be explored with better record quality than was available in his variable intensity recording on photographic media. (See Figure 4.) Analog devices are and will be available for various schemes for mixing and filtering for playing back these records.

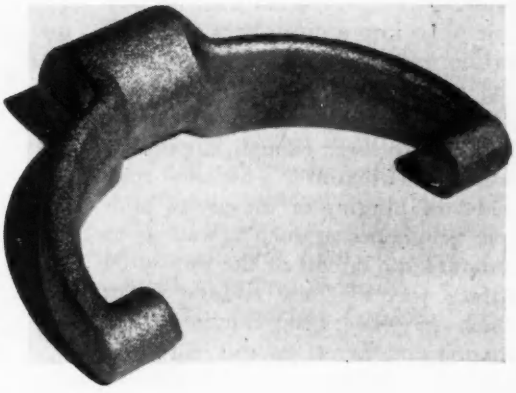
However, for investigation of the best schemes for analysis the digital machines present a means for filtering and mixing in a variety of nonlinear methods. This approach on digital machinery is particularly attractive when the program is in the formative stages. Considerable investigation can be achieved without going to the expense of constructing special circuits. In the later phases, where quantities of data must be handled and resolved, the digital machine may still have some application. It would seem that the decision—making apparatus available in the digital machine might permit more flexibility in handing a variety of work in selecting the proper filtering and mixing.

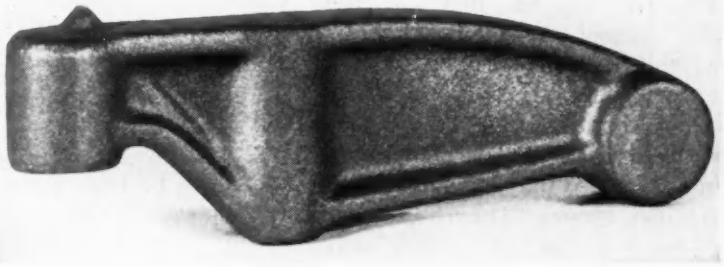
Also, the digital machine can make selections with regard to the processing of the data by a variety of computational schemes such as the numerical integration necessary for curved path ray tracing, steep dip computations, etc.

Mention was made of filtering effects with digital equipment. This digital approach to filtering allows the laboratory to test a wide variety of filters on a number of records without performing the work that would be necessary to build filters with prescribed characteristics. The filter designer merely suggests a proposed unit impulse response and a set of records may then be passed through such a filter in far less time and at far less expense than would be required for the construction of the comparable electrical analog.

At the fundamental research end of the exploration business, it is now possible to make calculations which should be of enormous benefit to the understanding of the noise problem. Elastic surface waves in a layered earth are dispersive because of the finite dimensions involved; hence, there is an equation, the period equation, which relates frequency to phase and group velocity. These







From Bethlehem's Showcase of DROP FORGINGS

In our Bethlehem drop forge shop we have a big display board showing hundreds of the designs we have made in recent years.

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equations have been written down for an arbitrary stratification. But to date only a very small number of physical cases have been computed. These equations, in general, are transcendental and no explicit solutions are to be expected. Nevertheless, the equations are relatively simple in form and although they involve a very large number of constants they are of the type easily handled on medium size computing machines.

As soon as dispersion curves are on hand for a reasonable number of physical cases, it should then be possible to go into a given area and with certain easily obtained velocity, density, and thickness values to predict those phases which are likely to be present with large enough amplitudes to be troublesome. This then may guide the filtering or the use of multiple geophones in such a way as to minimize the effects of the unwanted surface waves. These surface waves which may have been caused by diffraction and, hence, by the reflections themselves cannot be expected to start at the shot point time zero.

For this reason, they are often called random noise, although in reality their frequencies and velocities are completely predictable on the basis of dispersion curves. In a similar way, much more information than is now obtained may be learned from refraction records. The theory has progressed to the point where some computations would shed much needed light on the meaning of refraction arrivals.

As more and more people begin to appreciate that machines are available which can produce answers formerly too tedious, too costly, or impossible to achieve, there will be increased investigation into many new areas which should bring fascinating results. The oil industry has been aware of such equipment and many computers are already employed in applications within the industry. The solution of one problem generally suggests applicability of this solution or portions of it to another problem. This propagation will lead to the successful solution of many fundamental problems in the industry. And it promises some interesting years ahead. —**The End**

Better Health For Executives

Part 4
About Your Recreation

By DR. B. B. REEVE,
Medical Director,
Standard Oil Company (Indiana)

MORE THAN MOST other men do, you executives calculate risks, then act.

This executive technique has helped give the people of our nation more good things and more leisure than people anywhere else in the world have been able to achieve. More leisure time for recreation and advances in medical science have combined to improve health and lengthen lives.

You executives, however, as a group, keep on taking the calculated risk of all work and no play. True, it makes "jack," but it also makes him a dull boy, and often he drops dead.

To keep in good health, it is essential for every executive to get recreation. It's simply too important a fact of life to be neglected, or denied as a calculated risk.

For employes, executives have come to recognize the values of recreation. Time and motion studies demonstrate the costly effects of fatigue on production. Executives have found ways to make increased production pay for vacation periods, shorter working hours, longer week ends, and other recreation for employes.

But you executives have too often failed to consider the values of your own recreation. What's good for the corporate body is good for your body. In fact, recreation can work for you.

Recreation can help give you perspective. If you can become absorbed in something different from your working responsibility, even for a little while, you will return to your work immeasurably refreshed. You will find yourself studying the problems you must solve with renewed vigor—from fresh, more balanced points of view. Out under the clear sky, the solution to a big problem may become suddenly clear.

One of the best things about recreation is, of course, the freedom you have to choose interesting, refreshing things to do with your leisure time. To all the traditional hobbies, hundreds of new ones have recently been added. In fact, most of today's how-to-do-it and do-it-yourself hobbies seem tailor-made for you.

I'd suggest that you don't putter around about it. Be yourself, make up your mind to it, pick out one or two things you know you're interested in, and do something about it. While you're at it, take the calculated risk of a subject or a field that's not at all related to what your work demands you to interest yourself in. That's the way to real recreation.

If you've never tried it, you'll be surprised what wonders of recreation you can achieve for yourself in one midweek evening. And week-ends are opportunities for refreshing vacations you'll hardly believe possible.

Then there's vacation time—a real problem to many of you executives. There's only one rule to conform to: choose what you'd personally most like to do of the things you can do.

Some men do best with short vacations, some with longer ones. Others seem helped more by brief vacations at more frequent intervals. The secret is to get away from your work—completely—when you do go on vacation.

There are cautions to observe, of course.

A man who works most of the time at his desk shouldn't go out and perform physical feats beyond his capacity. If this means you, and you like to play golf, avoid fatigue rather than court it. As you grow older, especially, don't overestimate the capacity of your heart.

If you have stomach ulcers, don't misuse a vacation to do things that aggravate them. And avoid tension-type activities, whatever they are, for you.

Don't wear yourself down driving long distances a day to get to, and then back from, some resort. After all, you don't want it to be your last resort. Don't try to get a complete sun tan all in one day.

Whatever else it is, it isn't good business to come back to your work fatigued and exhausted from a vacation you've made too strenuous. Plan instead, like your real executive self, the kind of a vacation that best suits your own personal needs—and come back, refreshed.

The way to better executive health is simple:

Manage your health.

Be moderate and last longer.

This concludes the health series by Dr. Reeve.

Note: The author is dealing in generalities. He is in no way offering relief for, nor suggesting treatment for specific ailments.

HAND-TO-HEAD POSTURE of geologist in background seems to indicate that underwater search is a real headache.

Skin-Diving Oil Sleuths Search the Ocean Floor

Socony-Vacuum geologists first to put aqualung diving technique to industrial use. Gulf studied for hints of where oil-bearing sediments were deposited.

SOCONY-VACUUM OIL COMPANY geologists are pioneers in skin-diving for scientific research.

As part of a project to develop better ways of finding oil on land and underwater, the scientists have been studying the sediments deposited on the ocean bottom in comparatively recent geologic times in order to glean clues as to how where oil-bearing sediments were deposited in ancient days.

Employing the aqualung diving technique for the first time in industrial history, four geologists and two geological technicians took part in the recently completed expedition—second in ten months. The scientists are members of the Field Research Laboratories of Magnolia Petroleum Company, Socony-Vacuum affiliate at Dallas.

They operated from a 65-foot converted shrimp boat, sometimes working in 65 feet of water, 45 miles south and east of Galveston.

A principal objective of the study was to develop techniques for predicting the presence and location of limestone reefs and sandstone bars in ancient rock formations.

Studying the environments in which sediments have been deposited in recent geologic times offers a key to understanding how ancient sediments were formed. To help indentify these environments, the scientists collected samples of starfish, snails, shellfish, and other marine animal and plant life found on and under the ocean floor. To obtain the needed samples the scientists used three principal techniques—diving, dredging, and coring.

The dredge consisted of an ordinary fishing net mounted in a steel mouth with teeth along the underside. By towing the dredge from the stern of the boat, the researchers brought up about 300 pounds of sediments and marine life in each haul. Samples of each catch were stored in steel cans, labeled according to location, and retained for laboratory analysis.

To get samples of older sediments several feet below the surface, a core barrel was lowered over the side, weighted on top, and plunged into the bottom. Later the plastic liners containing the cores were pulled out of the pipe and stowed away for laboratory study.

Skin-diving made it possible to extend the range of underwater information obtainable. They observed marine flora and fauna at first hand. They used dandelion diggers to loosen some of the specimens from the sand and coral bottom and brought them to the surface in gunnysacks. They took photographs with a camera mounted in a watertight case. They made underwater notes on their observations by writing with pencils on plastic slates strapped to their thighs.

Using a device called a current-meter, the divers calculated the force of underwater currents which dump sediments into the Gulf, so that these currents could be plotted on a master chart along with other data.

The Socony-Vacuum scientists made their first underwater expedition last October. They had prepared for it by spending a week learning to dive in the San Marcos River at San Marcos, Texas. When they finished the course, all were able to pass the diving test the Navy gives its frogmen.

—The End

Leadership in Big Business Is Precarious, Seven-Year Study Shows

When the river of misunderstanding that divides our troubled world is traced back to its black and bitter source springs, there is found the 100-year-old denunciation of Karl Marx against the accumulation of goods beyond bare subsistence.

Marx held that the concentration of wealth in the hands of a few would hasten the demise of the competitive free-enterprise system. It is upon this mendacious theory, with its tinseled appeal to the have-nots, that the cunning men of communism have built the spreading empire of hate. It matters not that they probably don't believe a word of what they preach; but it matters a great deal that at every opportunity their preachments be shouted down by the truth, lest finally they stuff with poison all the world's empty bellies and empty heads.

The truth has been soundly phrased once again in a new book, *Big Enterprise in a Competitive System,* by A. D. H. Kaplan, an economist who spent seven years studying big business for the Brookings Institution. Kaplan focused upon the 100 largest industrial institutions of the early 1900's and followed their history for the first half of the century. His findings are in sharp dispute with the doctrine that bigness fattens at the expense of others, a cannibalistic giant among pygmies. Kaplan found that to be big definitely does not guarantee prosperity, or even survival, in competition with fresh new ideas and despite the vagaries of a changing economy.

Of the 100 largest corporations in 1909, only 36 were on a similar list for 1948. And among these 36 there were changes. Standard Oil Company (N. J.), once Standard Oil Company, had moved up to first place from second, and The Texas Company had risen from 87th to sixth.

Moreover, five companies among the first ten on the 1948 roster did not appear among the first 100 in 1909—companies like Standard Oil Company (Indiana), which is fourth; Socony-Vacuum Oil Company, fifth; and E. I. du Pont de Nemours & Company, eighth.

Kaplan's comment, a mild masterpiece of understatement: "Industrial leadership at the big business level is precarious."

One mighty factor in shaping the fate of individual enterprises has been the country's population growth, bringing as it has a heightened demand for the good things being produced and creating competition in the production of those good things.

Where, 53 years ago, there were only four industrial companies with assets of more than $200 million, in 1951 there were 15 with assets exceeding $1 billion, and more than twice as many with assets above $500 million. Likewise, the total number of businesses has grown faster than the population, increasing from 15.4 per 1000 to 17.

The development of new products has also caused ponderous shifts in the economic tide, bringing whole new industries to the crest, pushing back others. In 1909, the iron and steel industry held 30.8 percent of the assets of the 100 largest companies. By 1948, this figure had dropped to 12 percent, while the petroleum industry grew from 8 percent to 29 percent.

Kaplan's conclusions: "Big business . . . makes a contribution to the total economy that cannot be made by smaller-scale enterprises. . . . Big business has not merely been kept effectively subject to a competitive system; on the whole it has also made an essential contribution to its scope, vitality and effectiveness."

Effect of Gas Prices on Oil Stocks Argued

That the price of natural gas is too low cannot be argued in the light of its Btu value.

But just how much effect this underpricing of natural gas has on present excess petroleum stocks is a matter that can be, and is being, argued stoutly.

It has been reported that Interior Department officials are showing Congressmen charts which attribute the plight of domestic oil producers to the growth of natural gas rather than oil imports.

Another on that side of the debate is T. S. Petersen, able and articulate president of Standard Oil Company of California.

In a letter to Chairman Ernest O. Thompson of the Texas Railroad Commission, Petersen maintained: "Marked success of natural gas in competing with petroleum has been largely due to its extremely low by-product value. In early years of growth in marketing natural gas, its field price amounted to only two or three pennies per mcf, far below its inherent Btu value related to prices for crude oil.

"The field price of natural gas in Texas is now in the neighborhood of 10 cents per mcf. This in terms of the equivalent crude oil value is about 60 cents, compared to a posted price of light crude oil of approximately $3 per barrel.

"This leads to the thought that royalties paid to landowners are inordinately low, and in no sense compensates them for the true value of the natural gas being produced.

"Until such time as field prices for gas have come into closer balance with real values paid to producers of crude oil, property and royalty owners can continue to expect meager returns and crude oil will suffer still further inroads in its markets."

here's the long ...and the short

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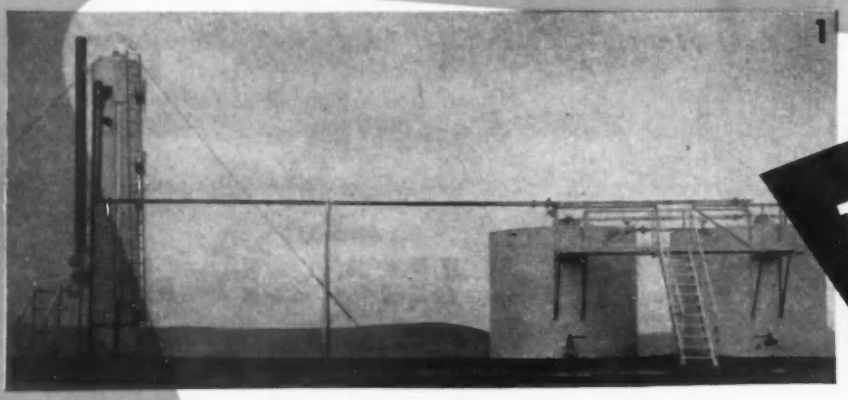

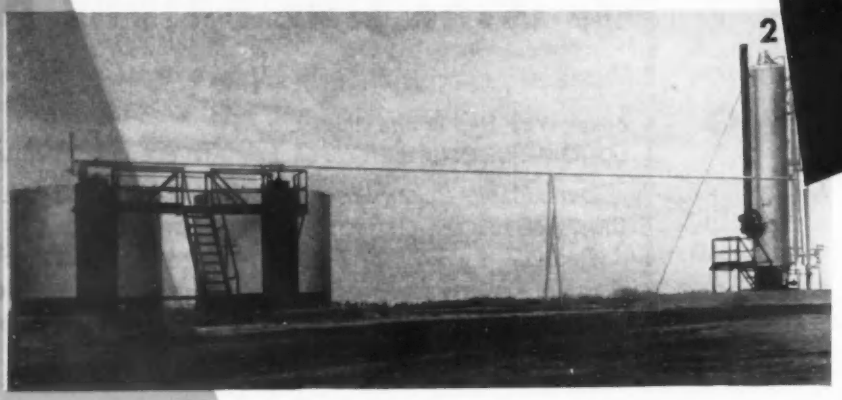

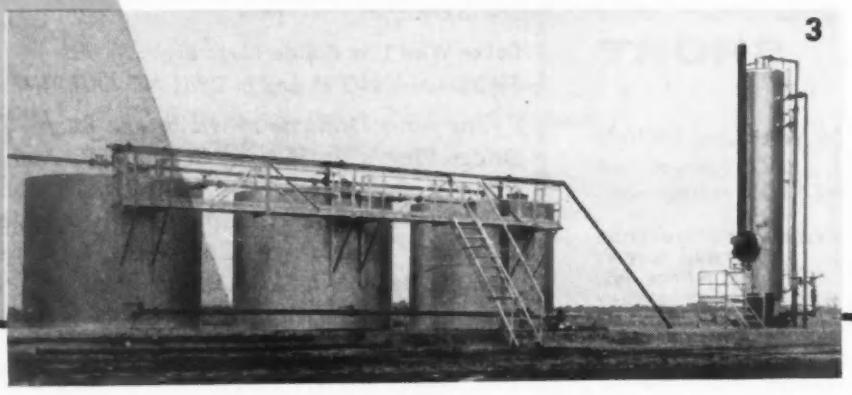

Photo 1 shows a Type "S" Treater being used as an atmospheric vessel—that is, with no water, oil or gas valves required—because there is no gas in the formation being produced. Commercial fuel gas is used for firing the treater. The overhead flow line from treater to stock tanks is slightly inclined to assist the flow of the low gravity Arbuckle oil, especially during cold weather.

Photo 2 shows a Type "S" Treater being used in low pressure service with water, oil and gas valves installed—but still using an inclined overhead flow line from treater to tanks, because the small amount of gas in this formation is separated by the treater and is used for fuel gas. This set-up is used many times when initial wells come in without gas, and subsequent wells produce gas. The treater is originally installed as an atmospheric unit, and is later equipped with valves to handle gas found in subsequent drilling.

Conversely, some areas may have 2 or 3 million feet of gas flow when drilled in, but due to the small reserve, the gas supply is depleted in a relatively short time. In these circumstances, it is a common practice to install valves on an inclined flow line from the treater. This makes it possible to handle large amounts of gas when wells are first drilled. As the gas is depleted, the valves are removed and the treater is used as an atmospheric unit.

Photo 3 shows a 4' x 21' Type "S" Treater in conventional service with water, oil and gas valves installed near the ground. Because of sufficient gas pressure and reserves, and because the oil is of high gravity and does not present a flow problem, the flow line is underground with a riser line at the stock tanks.

This unit has been handling 20 bbls. of flowing oil per hr. @ 90° F. rise in temperature, with approximately 2MM-SCF of gas per day. Pipe line oil has been produced *without interruption* since the well was opened. Other nearby operators with the same conditions who installed separators, heaters and flow tanks at considerably higher initial cost were *not able* to continuously produce pipe line oil. They later found it necessary to re-equip with flow treaters.

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...Specify the BS&B Type "S" EMULSION TREATER!

The BS&B Type "S" Emulsion Treater is one of the most versatile and adaptable treaters ever built for handling a wide range of field treating problems, because of the simple field modifications which can be made to adapt it quickly and inexpensively to local operating conditions!

It can be operated:

1. With or without water, oil and gas valves (as a pressure or an atmospheric unit).
2. With inclined overhead flow line, or with underground flow line.
3. With up to 6 ft. of hay filter section, or without hay filter section.
4. Without firebox, but with hay filter section (for heatless treating).

During the past five years, this unit has performed with outstanding success in all sections of Kansas, as well as in other widely varying locations, under the following range of conditions:

1. 17° API dead Arbuckle Oil w/1.004 Salt Water. (This oil congeals at high temperature.)
2. 19° API Kansas City Oil w/entrained gas and 1.005 Salt Water.
3. 42° API and over w/gas — (difficulty caused by small quantities of water, flow-cut into the oil.)
4. Mixtures of low gravity Arbuckle Oil and high gravity Kansas City Oil, or vice versa.

If you'd like more information on the BS&B Type "S" Emulsion Treater, or on any other item of BS&B Oilfield Production Equipment, call your BS&B Representative or write to...

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EFFICIENCY OVER 60 YEARS BS&B RELIABILITY

By **RAY L. DUDLEY,** Publisher, and **WARREN L. BAKER,** Editor

Gasoline Yields Must Be Cut

EXCESSIVE GASOLINE STOCKS are likely to cause the industry considerable trouble next year. Unless refiners wage a determined and constant fight during the next six months, United States gasoline inventories will be far too excessive by next spring.

The problem ahead is for refiners to make enough distillate fuel oil without making too much gasoline. The obvious need is a major adjustment of refinery yields from gasoline to distillate fuels, plus holding of runs to stills at reasonable levels.

On the one hand, the low motor fuel consuming season is being entered with gasoline stocks already at burdensome levels. Even normal winter additions will boost motor fuel inventories above desirable levels.

On the other hand, distillate fuel inventories are slightly below year ago levels, and demand is expected to be larger this year. Consequently, more distillate fuel must be made this winter. If colder than normal weather is experienced, distillate fuel requirements will be far above last winter.

Increased U. S. refinery runs would provide enough distillate fuel oil, but would result in the manufacture of far too much gasoline. Reduced yields of gasoline and higher yields of distillate is the only way for refiners to satisfactorily solve the problem.

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GASOLINE IS THE PROBLEM. Stocks of this product have been excessive for many months. Failure of refiners to trim runs to stills have made it impossible to reduce this surplus sufficiently.

Recent high runs to stills have killed any prospects for much improvement in the gasoline situation this year. During the four weeks ended August 13 runs to stills were cut to an average of about 6,750,000 barrels daily, and 5½ million barrels of gasoline was taken from storage. However, refiners permitted runs to increase to 6,950,000 barrels per day during the four weeks ended September 10, and only 3 million barrels were taken from storage. Withdrawals will be replaced by additions now that the heavy motoring season is over until next spring.

U. S. inventories of gasoline on September 10 amounted to 153¼ million barrels, 11¾ million more than a year ago and they were too big last year. They are at least 15 million barrels larger than they should be at this time of the year. Although consumption during the first eight months of this year was 1.5 percent above the like 1953 period, stocks are only 26 million barrels under the peak which existed at the end of last March. The gasoline outlook is not helped by current inventories located east of California being 14 million barrels above the corresponding date of 1953.

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THE ONLY PROBLEM is gasoline, other products are in good balance with demand. Nevertheless, the outlook is serious. If refiners fail to prevent the accumulation of too much motor fuel this winter, the industry's whole price structure can be damaged next spring.

Curtailed producing rates have reduced crude oil stocks in late weeks. U. S. inventories on September 11 stood at 273⅓ million barrels, down 6½ million barrels in the last four weeks and 7½ million below year ago levels. However, probable surplus gasoline inventories next spring could bring lower motor fuel prices, and renew the threat of lower U.S. crude postings regardless of a satisfactory crude position.

Distillate fuel stocks on September 10 amounted to 121¾ million barrels, down 3½ million from a year ago. These inventories will begin to decline shortly, as the heating season starts. With demand expected to be higher than a year ago, distillate supplies are a little on the low side. To make enough distillate, refiners will be tempted to boost runs to stills. Unless drastic reductions in gasoline yields are made, higher runs would result in the manufacture of far too much gasoline.

U. S. residual fuel oil stocks also are in good shape. While U. S. inventories of residual are 5 million barrels above last year, all the increase is located in California. Stocks east of California are 3⅓ million barrels below 1953 levels, while California inventories are 8⅓ million barrels.

Consequently, the industry's economic outlook depends entirely on how refiners handle the gasoline problem during the next six months.

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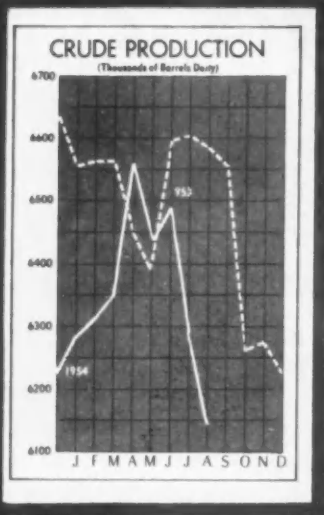
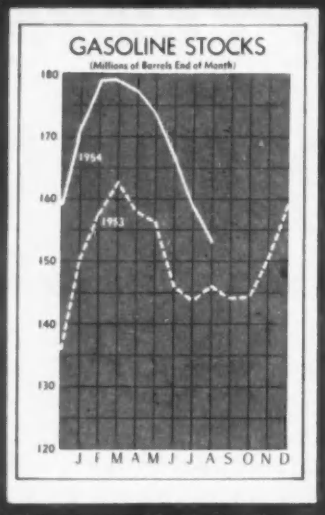
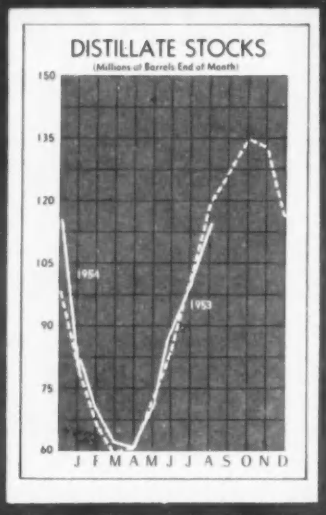
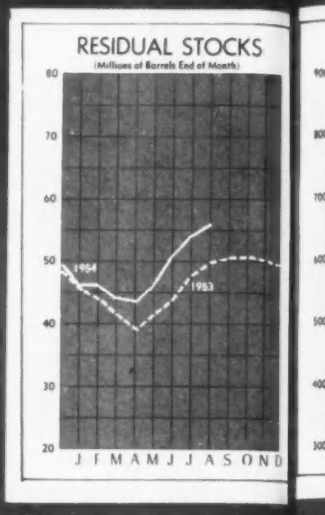
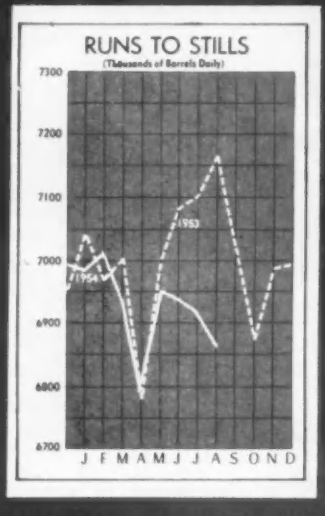
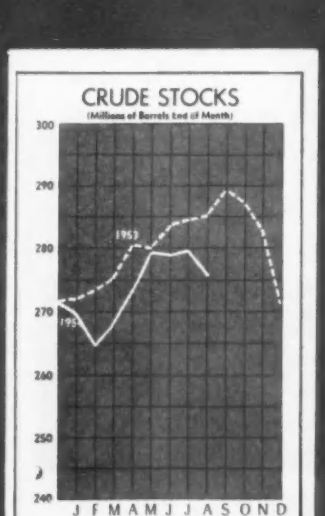












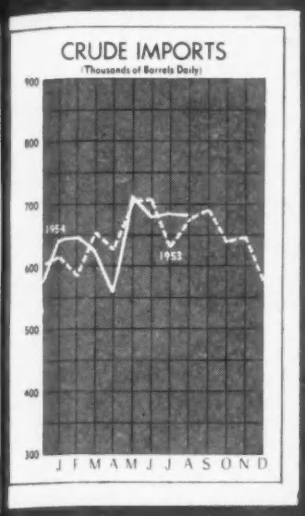
Petroleum Trends in U. S. . . .

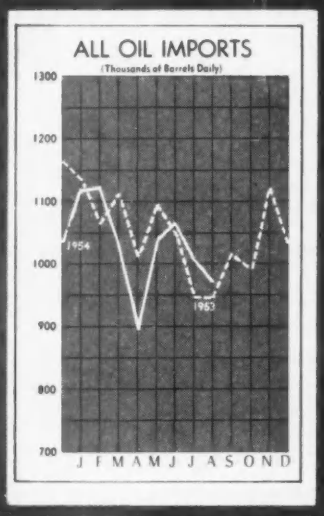
By CECIL W. SMITH, World Oil Staff

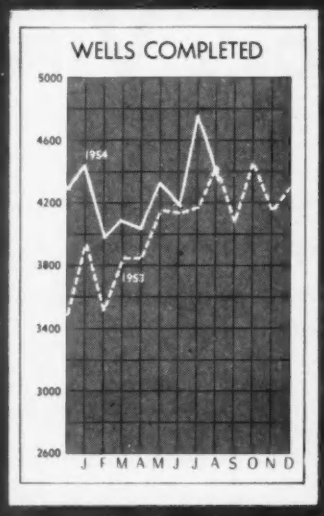
U. S. Crude Production by States

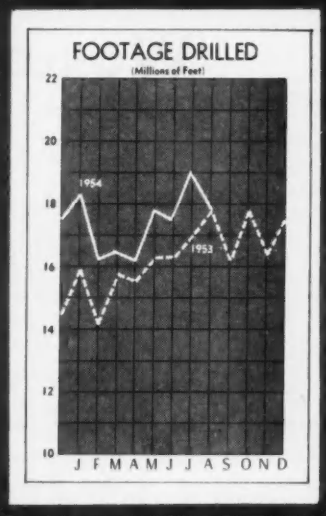
(THOUSANDS OF BARRELS)

STATE or DISTRICT	DAILY AVERAGE PRODUCTION				TOTAL PRODUCTION First Eight Months		
	August, 1954	July, 1954	August, 1953	% Diff. August, '53-'54	1954	1953	% Diff. '53-'54
Alabama	4.2	4.3	4.7	— 10.6	1,077	1,154	— 6.7
Arkansas	76.5	77.0	82.6	— 7.4	19,484	19,797	— 1.6
California	968.0	977.9	998.5	— 3.1	239,389	242,726	— 1.4
Colorado	127.9	132.8	96.2	+ 33.0	27,331	21,004	+ 30.1
Florida	1.5	1.6	1.5	0.0	372	363	+ 2.5
Illinois	181.7	183.2	157.1	+ 15.6	43,593	38,828	+ 12.3
Indiana	28.5	28.6	35.9	— 20.6	7,515	8,853	— 15.1
Kansas	320.9	330.4	328.1	— 2.2	79,686	80,471	— 1.0
Kentucky	36.2	36.0	32.8	+ 10.4	8,983	7,598	+ 18.2
Louisiana	642.2	672.4	708.0	— 9.3	168,544	171,584	— 1.8
North Louisiana	110.4	111.8	113.0	— 2.3	27,819	27,942	— 0.4
South Louisiana	531.8	560.6	595.0	— 10.6	140,725	143,642	— 2.0
Michigan	30.6	33.2	32.8	— 6.7	8,048	8,194	— 1.8
Mississippi	92.0	90.5	97.2	— 5.4	22,526	23,877	— 5.7
Missouri	0.1	0.1	0.1		45	16	+181.3
Montana	40.1	38.9	32.2	+ 24.5	8,685	7,593	+ 14.4
Nebraska	19.2	19.4	18.7	+ 2.7	4,712	3,993	+ 18.0
New Mexico	205.4	203.4	199.4	+ 3.0	49,242	46,082	+ 6.8
New York	11.0	11.2	10.0	+ 10.0	2,337	2,579	— 9.4
North Dakota	13.5	14.0	14.4	+ 6.2	3,465	3,513	— 1.4
Ohio	9.8	9.8	9.8	0.0	2,575	2,291	+ 12.4
Oklahoma	493.7	491.0	579.5	— 14.8	127,652	136,997	— 6.8
Pennsylvania	22.4	22.4	28.9	— 22.5	6,158	7,161	— 14.0
South Dakota	0.2	0.1			20		
Tennessee	0.1	0.1			11	8	+ 37.5
Texas	2,560.4	2,627.0	2,853.1	— 10.3	657,026	694,598	— 5.4
Dist. 1—South Central	41.6	41.6	39.7	+ 4.8	10,187	8,997	+ 13.2
Dist. 2—Middle Gulf	130.4	137.0	161.7	— 19.4	35,089	38,812	— 9.6
Dist. 3—Upper Gulf	423.4	438.5	476.6	— 11.2	107,714	116,124	— 7.2
Dist. 4—Lower Gulf-S.W.	226.0	238.3	274.8	— 17.8	60,073	63,983	— 6.1
Dist. 5—East Central	42.4	43.0	50.1	— 15.4	10,837	12,065	— 10.2
Dist. 6—Northeast	315.7	331.7	379.6	— 16.8	84,215	92,600	— 9.1
Dist. 7-B—North Central	125.4	119.2	119.8	+ 4.7	30,513	27,140	+ 12.4
Dist. 7-C—West Central	174.8	178.0	174.0	+ 0.4	44,060	40,498	+ 8.8
Dist. 8—West	817.8	838.8	931.3	— 12.2	208,243	223,974	— 7.0
Dist. 9—North	179.3	178.9	187.9	— 4.6	45,467	44,006	+ 3.3
Dist. 10—Panhandle	83.6	82.0	76.5	+ 9.3	19,952	18,276	+ 9.2
Utah	4.4	5.4	4.9	— 10.2	1,262	1,239	+ 1.8
Virginia	0.1	0.1	0.0		10	7	+ 42.8
West Virginia	8.1	8.0	8.4	— 3.6	1,977	1,891	+ 4.5
Wyoming	248.1	263.4	247.7	+ 0.2	61,358	55,063	+ 11.4
Total United States	6,146.8	6,282.0	6,582.5	— 6.6	1,553,083	1,587,480	— 2.2









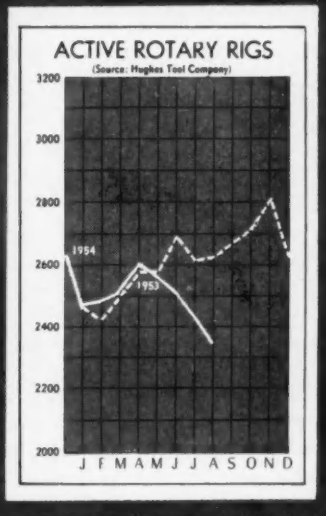
- **Crude output lowest in two years**
- **Drop in refining rates continued**
- **Drilling holds lead over 1953**

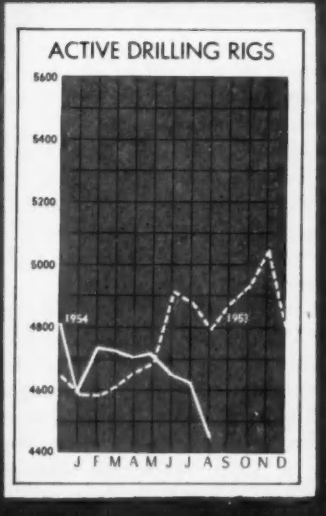
Crude Oil and Refined Products Trends

(THOUSANDS OF BARRELS)

MONTH	CRUDE OIL			GASOLINE		DISTILLATE FUEL		RESIDUAL FUEL		DAILY IMPORTS	
	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Crude Oil	Total Oils
1952:											
June	6,197	6,825	285,964	3,169	120,166	1,455	65,911	1,228	45,688	581	911
July	6,093	6,927	275,951	3,295	116,566	1,475	85,775	1,237	52,245	597	892
August	6,219	7,118	264,368	3,377	118,592	1,514	104,257	1,252	54,061	632	879
September	6,518	7,017	264,723	3,428	120,991	1,502	117,252	1,230	56,200	615	932
October	6,518	6,883	269,776	3,301	120,062	1,458	120,721	1,203	53,052	643	1,037
November	6,487	7,049	267,852	3,416	129,509	1,510	116,096	1,299	53,069	624	984
December	6,634	6,952	271,928	3,361	136,028	1,509	99,582	1,302	48,706	603	1,165
1953:											
January	6,555	7,042	272,250	3,384	150,518	1,528	80,655	1,307	45,910	616	1,135
February	6,562	6,969	273,589	3,379	157,873	1,505	67,167	1,275	44,178	586	1,066
March	6,531	7,002	275,665	3,319	162,731	1,489	59,802	1,256	41,600	655	1,112
April	6,446	6,781	280,487	3,282	158,032	1,424	61,349	1,219	39,572	628	1,010
May	6,390	7,002	280,308	3,459	156,415	1,400	73,706	1,197	41,795	703	1,096
June	6,595	7,081	283,715	3,467	146,196	1,462	84,504	1,238	43,801	707	1,050
July	6,603	7,103	284,976	3,583	143,916	1,441	102,394	1,224	47,966	629	946
August	6,583	7,163	285,352	3,592	146,050	1,437	119,542	1,222	50,007	672	946
September	6,557	7,023	289,614	3,521	144,184	1,448	126,709	1,203	50,516	692	1,013
October	6,262	6,872	287,541	3,437	144,495	1,462	135,409	1,184	50,820	639	990
November	6,277	6,987	283,021	3,528	150,747	1,463	133,381	1,223	51,267	648	1,120
December	6,238	6,964	276,676	3,628	159,949	1,441	111,944	1,247	49,370	598	1,121
1954:											
January	6,240	6,947	270,811	3,431	171,704	1,550	81,044	1,271	47,474	617	1,143
February	6,379	7,068	266,918	3,476	179,950	1,545	70,390	1,241	47,119	621	1,144
March	6,507	6,923	271,867	3,375	181,297	1,458	60,270	1,168	44,249	654	1,088
April	6,615	6,811	280,310	3,404	177,006	1,374	61,721	1,140	44,362	574	950
May	6,471	7,038	282,250	3,482	177,606	1,372	73,581	1,148	47,009	708	1,021
June	6,500	6,947	285,155	3,483	165,404	1,399	86,325	1,123	50,216	624	999
July	6,282	6,922	279,744	3,378	158,174	1,412	101,101	1,108	54,735	686	1,011
August	6,147	6,859	275,543	3,388	153,608	1,438	116,398	1,092	56,069	683	972
August, 1954 Change											
In Month	−135	−63	−4,201	+10	−4,566	+26	+15,297	−16	+1,334	−3	−39
In Year	−436	−304	−9,809	+204	−7,558	+1	−3,144	−130	+6,062	+11	+26
Week Ended:											
9-10-54	6,178	6,989	273,337	3,420	153,279	1,442	121,734	1,103	56,725	741	1,038
9-11-53	6,506	7,216	280,865	3,461	141,488	1,452	125,330	1,259	51,760	598	946

Source: Data for last two months from API; prior monthly data from Bureau of Mines.





WORLD OIL'S VIEWS OF THE NEWS

- Gas escape clauses invalid, says FPC . . . IPAA forecast revised downward . . .
- Statesmanship needed now, industry leaders declare . . . Union merger sure . . .
- World oil movement swings south-north . . . Louisiana tidelands suits certain.

'Escape Clauses Out'—FPC

The Federal Power Commission is ready to clamp down on any gas company which tries to evade commission jurisdiction by invoking "escape clauses" in sales contracts to terminate service.

Nearly all long-term gas contracts contain a provision under which the gas seller reserves the right to shut off sales in event the FPC or kindred authority should impose regulations on production, gathering, processing, or sale of natural gas.

The clause has become a bone of legal contention since the Supreme Court's historic decision June 7 in the Phillips Petroleum Company case holding that the FPC must take jurisdiction over, and fix prices on, all gas sold in interstate commerce.

Asked if the Commission would sanction such provisions, in view of the Court's decision, an FPC lawyer (who wished to remain anonymous) returned an emphatic "No!"

"No company has the right to terminate a contract without FPC approval," he added. "All of them are governed by the Natural Gas Act of 1938, and subject to the latest Supreme Court interpretation in the Phillips case."

He said that so far, no test cases have been filed, but if any are, the commission is ready to challenge them and will do so swiftly.

The issue was to come up for considerable discussion late last month when the commission received briefs and heard oral arguments on petitions for a rehearing of its controversial order 174-A. The order—growing out of the Phillips decree—requires independent producers to obtain certificates of necessity to operate and also subjects all their contracts, regardless of price escalator or escape clauses, to FPC approval.

A commission spokesman predicted that the FPC would stand its ground. In this connection he cited the Commission's Sept. 8 statement fixing the dates for filing briefs and hearing oral arguments. At that time the commission denied all requests for a stay of order 174-A, as "without reasonable justification."

This meant it will press ahead with enforcement of the order until such time as the petitioners—or perhaps the Supreme Court—can change its mind.

The spokesman was not in a position to say what might be the outgrowth of the burgeoning dispute. When the Sept. 6 filing deadline had passed, about 100 petitions had been filed. Meanwhile, Phillips filed a series of applications for certificates, and announced that those were only the start.

Many gas industry officials are still hoping for succor from the Supreme Court. The tribunal will have pending before it when it reconvenes Oct. 4 petitions for a rehearing of the Phillips case. The pleas were filed by Phillips and the states of Texas, Oklahoma and New Mexico.

The FPC itself would like to get out from under the court's edict because it regards its jurisdiction over natural gas at the well head as an invasion of state's rights. But it is equally determined to enforce the decree so long as it is on the books.

A bevy of oil and gas state senators, headed by Senate Democratic Leader Lyndon B. Johnson of Texas, are ready for an attempt to cancel the courts ruling with a new law, should it still be standing when the 84th Congress convenes in January.

Record Expansion Planned

Oil has scheduled expansion this year at a record rate of $2.8 billion, the Securities and Exchange Commission announced.

Expenditures for expansion by nondurable goods manufacturers in general face a 5 percent decline this year, it was reported.

The survey by SEC and the Commerce Department shows that business and industry as a whole will spend $26.7 billion for new plants and equipment this year, or 6 percent less than the all-time high of $28.4 billion in 1953.

TGT Drops Rate Hike Plea

The FPC's gas price freeze caused Tennessee Gas Transmission Company last month to drop its application for a $13.6 million annual increase in wholesale rates.

TGT's whole case hinged on expected increase this fall in the prices charged by independent producers. Tennessee had filed its rate boost application April 30. The FPC rate freeze order was announced July 16, with minor modifications on August 6.

In return for TGT abandonment of its rate increase application, FPC attorneys agreed not to complain about the company's present rates. FPC lawyers had contended that the company's present rates are about $3,750,000 too high.

IPAA Forecast Revised

Expansion in productive capacity at the present rate is not possible if imports continue to supply more than 1 million barrels per day of the U. S. market.

This was the assessment of oil's economic status delivered by H. B. Fell, chairman of the Independent Petroleum Association of America Supply and Demand Committee at the quarterly meeting of the Interstate Oil Compact Commission in Omaha.

Annual expansions in productive capacity have been averaging about 300,000 to 400,000 barrels daily, declared Fell, who estimated that average crude productive capacity during 1954 will be 8.1 million barrels daily compared with his forecast of 6.4 million barrels production. The latter figure is a decrease of 46,000 barrels daily from the estimate in May.

Total stocks for Sept. 1 were estimated by Fell at almost 760 million barrels, or about 25 million above last year and more than 16 million barrels higher than the earlier IPAA estimate.

Imports of crude and products have remained about the same as in 1953, and the outlook during the next three months is for a slight increase over the same period of 1953, he said.

Domestic production from June through August was about 5 percent below that period in 1953, he declared.

Looking ahead to the remainder of the year, Fell found reason for encouragement if (1) total domestic and export demand is above last year but 1 to 2 percent below the IPAA May forecast; (2) total stocks by Nov. 30 are no higher than last year; and (3) companies follow the imports schedules reported to the Texas Railroad Commission.

After

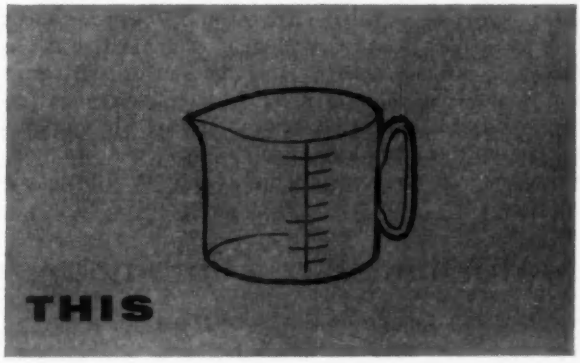
THE PAY IS LOCATED

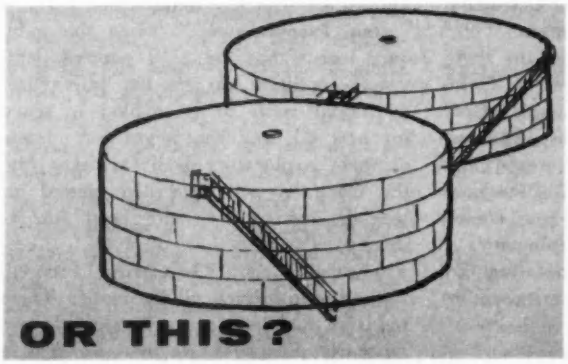
comes the big question

HOW MUCH?

Today, in many areas, operators who ask Lane-Wells that question are getting the answer—and getting it right. For Lane-Wells' QUANTITATIVE INTERPRETATION of Radioactivity Well Logs, wherever formation responses permit such interpretation, are providing estimates of reservoir potential which have been proved to be sufficiently accurate for all commercial purposes. The value of such data to men charged with the responsibility of planning production for maximum recovery can hardly be overestimated.

This service is being extended to other areas as rapidly as new or improved techniques are proved reliable and as sufficient other down-hole information is obtained and correlated to produce trustworthy results. Your Lane-Wells man can give you full information on the possibilities of QUANTITATIVE INTERPRETATION in your area and its value to your operations.





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let us tell you how QUANTITATIVE INTERPRETATION may give the answer

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C. J. Bauer Becomes Assistant OGD Chief

C. J. Bauer, formerly head of the Foreign Petroleum Economics Section of Standard Oil Company (N. J.) is sworn in as assistant director of the Oil and Gas Division of the Department of Interior last month. Witnessing the ceremony is Hugh A. Stewart, director of the Oil and Gas Division. Administering the oath of office to Bauer is C. C. Davidson, assistant chief clerk of the Initerior Department. Bauer's position of OGD will be directing the over-all activities in the development and coordination of plans to assure a world wide supply-demand balance. He will also be responsible for the function of the Foreign Petroleum Supply Committee and will represent the U. S. on the petroleum planning committee of the North Atlantic Treaty Organization.

Statesmanship, Diplomacy Are Vital Now

Greater advancement has come with the petroleum age than in any other era. Providence and Nature stored oil in the ground; daring curiosity of man eventually found it; progress born of it has served to develop it. Yet, the unmatched perversity of man has led the petroleum industry into a dangerous position.

One answer to at least part of the problem at hand, previously pointed to by industrial leaders, and underscored by Gen. Ernest O. Thompson, Texas Railroad Commission chairman, at the recent annual meeting of the National Petroleum Association in Atlantic City, is a combination of statesmanship and diplomacy.

They are the routes deemed best by industry leaders to offset the serious problems of:

- Renewed efforts to eliminate or reduce depletion allowance.
- Federal control through the Phillips case decision.

Senator Lyndon Johnson of Texas, Senate minority leader, made his views clear in an address before the Mid-Continent Oil and Gas Association's recent Houston meeting: "There is an immediate need to explain the oil industry to the public because an old issue is about to rise in a new and dangerous form. It is the drive to repeal or lower the oil depletion allowance."

J. Sayles Leach, chairman of the board, The Texas Company, forecast a blunt warning: Tampering with depletion allowance would be suicidal since its effect would be to abolish incentive to hunt for new oil sources at a time when such sources are urgently required.

Gen. Thompson said "when the public once learns that the 27½ percent depletion recognition in the tax laws causes additional wells to be drilled in search for new oil, and that eight out of nine of these exploratory wells are dry, then the Congress will be called blessed and wise in having seen the need for this incentive."

The public should be alerted to the continuing need for new oil discoveries. The oil industry has pointed to this need intermittently. But if the layman wants it officially, he has it, too.

Wrote R. B. Anderson, new deputy Secretary of Defense, on May 22, 1953, when he was Secretary of the Navy: "This figure (the then current U. S. daily proliquids of 7,059,000 barrels) is not sufficient to meet . . . requirements in . . . a national emergency."

" . . . Reliance must be placed on the drilling of new wells and developing of areas heretofore not fully developed rather than putting all our faith in proven reserves . . ."

Man can only search for oil, as Gen. Thompson points out. And search he will under the proper economic and government climate. But reduced depletion allowance and federal control over gas and/or oil, which could possibly result from the Supreme Court ruling that the Federal Power Commission holds in its regulatory grasp the price of natural gas at the wellhead, is not the oil man's definition of "proper."

It would behoove the public to study his view.

And it is fit that the oil industry lay it before them.

Union Merger Is Certainty

The iron hand of CIO President Walter Reuther, plus a few Reutherian threats, have made merger of the CIO's oil and chemical workers unions a certainty.

Elwood Swisher's United Gas, Coke and Chemical Workers approved the merger last month at their St. Louis convention, but not until Reuther said some harsh words which added up to an ultimatum.

Merge, he told rebellious delegates, or go your own way, without CIO financial or organizing support. His words were addressed primarily to West Virginia and Ohio locals which charged that O. A. (Jack) Knight's Oil Workers International was out to swallow up the UGCCW.

The merger was approved on a roll call vote of 667 to 192 after the rebels refused to make it unanimous.

Knight and Swisher called Reuther into the breach when the revolt threatened to get out of hand. The CIO president talked "cold turkey."

He said bluntly that neither union was strong enough to organize more than the fringe of their industries but that, together and backed by the CIO's exchequer and organizers, they could become one of the most powerful in the nation.

"Acting independently, you cannot raise the money to take on a big company," he said, "but the CIO can. But bear in mind, unless there is a merger the CIO will spend its money as it sees fit."

The vote of approval followed. All the combine needs now is approval by Knight's union, which will come at a cut-and-dried meeting in Cleveland Nov. 15, and a joint organization convention to be held by January 1.

Officers of the two unions will meet soon to work out details of the convention.

The combine will bring into being a 200,000-man union under which Reuther, Knight and Swisher hope to unify 1 million American and Canadian oil and chemical workers in a force strong enough to dominate the industries.

In the hot words hurled at St. Louis,

Knight denied he regarded the chemical workers as merely a "ripe plum" waiting to be plucked. He pledged the merger would be carried out "on equal terms" and that officers would be elected on a fair basis at the joint convention.

Swisher echoed these words but it took Reuther to pound them home.

No. 1 rebel was Andrew Bragg of UGCCW local 420, West Virginia. He pointed out that the oil and chemical workers have bitter jurisdictional differences, and added: "Reuther says: 'If you don't vote to please me, I'll cut your water off,' and I say to Brother Reuther: 'Brother, I'll just dig another well.' "

Another opponent was Director Robert Buchanan of District 5, Ohio and West Virginia. He said other CIO unions "have been watching our progress for the time when they could pick up one of the richest plums."

Reuther hailed the vote as the "first step" toward the 1 million-man union—a campaign which Knight originated. This union would embrace 30 CIO, AFL and independent organizations, most of which have been cold toward the movement but are now expected to display more interest.

Knight Keeps Powder Dry

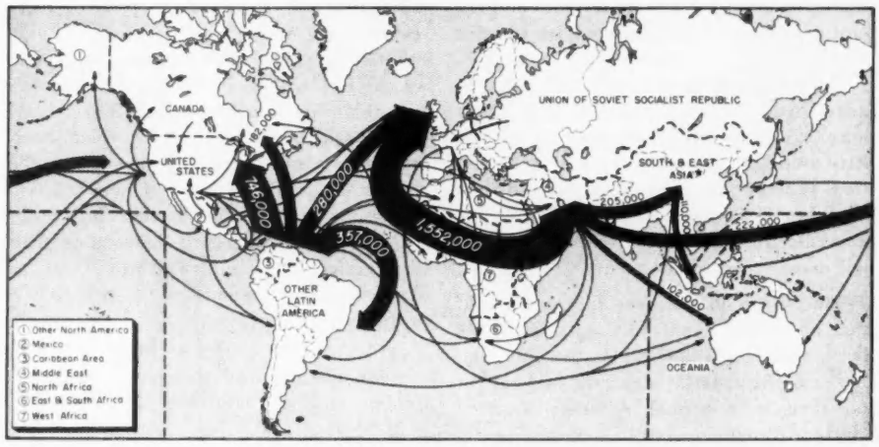
The Oil Workers International Union was still clinging to its "unloaded gun" policy in wage negotiations last month, but President O. A. Knight seemed to be reaching for the ammunition.

Under the headline, "Companies Spurn OWIU's Peaceful Wage Campaign," the official OWIU publication last month declared that "Companies with few minor exceptions . . . have refused to grant wage increases or even to discuss seriously the matter of wage increases."

The article recalled that the OWIU Policy Committee last June pledged the union would not strike, threaten to strike, or take strike votes in support of wage requests.

President Knight was quoted as saying: "We are becoming more and more convinced that reasonable, logical discussion of facts will not convince management of the justification of wage increases. We would have felt somewhat better about our experiment (the unloaded gun policy) if some of the major companies had actually engaged in full-scale and detailed discussions of the wage question with us, even if those discussions had not resulted in increases."

The OWIU will continue to negotiate on an "unloaded gun" basis, Knight added, "unless and until the Policy Committee or international convention changes policy. . . . I have no doubt the Policy Committee will carefully review policy when it meets in connection with the Nov. 15 international convention."



All movements indicated are barrels 42's daily. —Standard Oil Company (N. J.) map
*Excluding Soviet-dominated areas.

Oil Movement Swings to South-North

World oil movement, which prior to World War II was primarily from West to East, is now more nearly from South to North, largely from the Middle East to Europe and a growing volume from the Caribbean area to the U. S. and Canada. Due to the proximity of large-volume Middle East crude production to the greatly-expanded European refineries and the fact that supplementing U. S. domestic production with reasonable imports is desirable, there is little likelihood that the present pattern will change.

This is a summary of the remarks by Chester F. Smith, vice president and a director of Standard Oil Company (N. J.) at the annual meeting of the National Petroleum Association at Atlantic City in mid-September. Figures cited by Smith showed that Europe in 1938, with 300,000 barrels daily of refining capacity, depended on the U. S. and the Caribbean for 61 percent of its petroleum requirements. In 1953, Europe's refinery capacity had expanded 400 percent to 1,820,000 barrels daily, or to a level or near self-sufficiency in products, and the area received 78 percent of its petroleum needs from the Middle East.

Such a change in the international flow pattern, the Jersey Standard official stated, was logical because of the world currency situation since the war and the rapid development of Middle East oil production. While Middle East oil development was stimulated by the war, Europe's switch to that area as its major source of crude petroleum would have occurred regardless of a war because of the shorter tanker distance and the important part played in Middle East production by British and Dutch companies willing to accept soft European currencies in payment for oil.

Another significant development in international petroleum trade in the postwar years cited by Smith has been the erection of refinery capacity near the major consuming areas rather than near the large producing and export centers as was the pre-war practice. This, too, grew out of the currency situation since it is a saving in foreign exchange for consuming nations to import crude rather than finished products, he noted.

While the growth in refinery capacity has been most significant in Europe, total refining capacity expansion in the free world outside the U. S. has amounted to 127 percent since the war, or from 2.6 million to 5,908,000 barrels a day, it was stated. Smith estimated that in about three years when refineries now under construction or proposed are completed and with the Abadan plant in Iran operating at about 250,000 barrels daily, the free world's refinery capacity outside the U. S. will total almost 7 million barrels daily. By comparison, Smith said U. S. refining capacity at that time will be about 9,125,000 barrels a day.

Tidelands Suits Certain

The Justice and Interior Departments were caught napping last month when Louisiana offered for bid some of the offshore oil lands which the Federal government already had advertised for lease.

"Lawsuits are inevitable," said the high Department of Interior lawyer who insisted on remaining anonymous.

"The whole complicated situation is under close study," added a Justice department spokesman who also banned use of his name.

The move caught both departments by surprise, although each was aware some such situation might arise out of the new Louisiana law extending the state's historic coastal boundary three leagues into the sea.

The Interior department chose to ignore the law and offered for bid 1 million submerged acres beyond Louisiana's three-mile limit.

Louisiana then posted some of the same

lands for bid on the premise that the Federal government had invaded its rightful territory.

"We're going ahead with our sales as advertised," Interior's lawyer said. "But long, costly lawsuits are inevitable. The issue is drawn and it will have to be settled. Whether this will come through suits filed by oil companies, Louisiana, or the government makes no difference. There will have to be a settlement."

The Justice department spokesman said that agency will not move until there has been a thorough analysis of the situation. He said the Interior department had lost no time in apprising Attorney General Herbert Brownell, Jr., of Louisiana's action. This was taken to mean that Interior anticipates early legal action.

The Justice spokesman said Brownell could adopt one of at least three courses. First, he could file suit in a Louisiana court and use it as a basis for trying to work out an amicable agreement between Washington and Baton Rouge.

Second, he could appeal to Congress in January to establish by law Louisiana's exact offshore boundary. Or third, he could file an "original jurisdiction" suit in the Supreme Court, which upheld constitutionality of the so-called Tidelands law.

The spokesman stressed, however, that it is too early to say what Brownell might do. He said that in any event the chief issue will be the location of Louisiana's historic boundary.

The Interior attorney said "We're still counting our marbles. We haven't had a chance to analyze developments. The only thing we know for certain is that Louisiana has presented complications which only a legal test can untangle."

Telling the Story of Oil

Few Americans will be able to avoid seeing or hearing of the importance of the American oil industry during the week of October 10-16 when producers, refiners, transporters and marketers of petroleum celebrate the seventh annual Oil Progress Week.

The story of the industry, using the theme, "Oil Serves You," will be brought to the public in almost every community through the cooperative effort of thousands of competing American oil companies under the sponsorship of the American Petroleum Institute and directed by the Oil Industry Information Committee. All known methods of communication will be employed to tell the industry's story, ranging from speeches and movies to fashion shows and visits to petroleum installations.

One highlight of Oil Progress Week will be the premiere in many cities of the OIIC's sixth motion picture, a color film entitled "The Story of Colonel Drake." After its Oil Progress Week showing, the new film will commence a tour of most every U. S. town.

Probably the most unique premiere of the film will be in towns and cities lining the Ohio and Mississippi Rivers from Pittsburgh to New Orleans. A river showboat will visit the river towns where the Drake film will be shown. On board will be displays portraying the industry's progress. Personnel on board, in keeping with the period of the Drake film, will be dressed in the costumes of the late 1850's.

Dealers in 24 U. S. cities will participate in an "OPW Dealer Plan" in which service stations will distribute numbered folders to their customers and drawings will be held for prizes, ranging from TV sets to all-expense paid trips to Nassau. Fashion shows, featuring the OIIC's Magic Suitcase which contains a wardrobe of fashions for the women all made from petroleum, will be held in leading department stores and before many women's groups.

Petroleum's story will be presented to the schools, and in many communities high school students will participate in "Oil Man for a Day" programs. The students will visit local petroleum installations and will "work" in the wide range of oil industry jobs.

Oil Taxes Top $5 Billion

It is not unusual for an oil company to pay more in taxes than in dividends.

It is not unusual for taxes to exceed payrolls.

This is the situation which has caused the API to stamp on some of its stationery this slogan: "With such a tax on gasoline, why not call it Taxoline."

Taxes on gasoline and other petroleum products have jumped to almost $5 billion a year, according to the API's tax economic bulletin. Federal, state and local taxes on petroleum products have mounted from $1 billion in 1933 to $4.9 billion in 1953, or nearly five-fold. The 1954 total will be higher.

Here is what some companies cited by the API said in their stockholder reports:

Cities Service Oil Company—"Gasoline now carries a tax equal to 35 percent of the average retail price. . . . The end is not in sight."

Esso Standard Oil Company—"In 1953 Esso paid federal, state and local governments $301,700,000 in taxes—$6 for every barrel sold."

Lion Oil Company—"Gasoline taxes added up to more money than was collected by all states from all tax revenue sources in any fiscal year up to 1936."

Sun Oil Company—"The bill on gasoline has risen to spectacular heights. The continuation of the federal tax is especially to be deplored."

Chances of immediate relief are dim. Gasoline taxes, amounting to about $3 billion per year, are the topic of a dispute between President Eisenhower and the National governors conference, could be a major issue in the next Congress.

The governors want the government to get out of the gasoline tax field. The President is determined to stand pat until the federal budget is in the black. He opposed all attempts to tamper with the levy this year, but did appoint an Inter-governmental Relations Committee which will report next year.

There is also some question whether the gasoline tax problem can be separated from the President's $50 billion, long-range highway building program. Gasoline taxes are the federal government's method of highway financing.

GSA, Producers at Odds

General Services Administration, the government's purchasing agency, is embroiled with independent oil producers and Democratic Congressman John Jarman of Oklahoma over purchases of foreign oil for the military under the "Buy American" Act.

The wrangle stemmed from a GSA ruling at Dallas, Texas, couched in unfortunate language. The GSA agency said, essentially, that crude products are exempt from the act because the domestic crude supply is insufficient. Domestic producers, who have long fought oil imports, took exception to the ruling.

Representative Jarman insisted in a sharp letter to GSA Chief Edmund F. Mansure that the government should not buy oil abroad "when there is a more than adequate supply at home."

Mansure replied, in effect, that he was caught in the middle of a dispute between independents and the National Oil Jobbers Council, representing 12,000 to 15,000 members. He said the Council demands that the act be waived because its members are unable to pedigree the oil they sell as either foreign or domestic.

Labeling the rift as "a controversy between independents and the Council," Mansure promised to seek "a satisfactory solution." And his solution will be announced after the Independent Petroleum Association of America gives him a new appraisal of the current and potential domestic supply.

Navy Opens Alaska Records

Heightened interest by a number of oil companies has followed the Navy's release for public inspection of all well record and geophysical data on costly oil operations in Naval Petroleum Reserve 4 in Northern Alaska. It is believed that this move is a prelude to opening the region to public entry some time in the future.

Mr. 'H' was excited...

Mr. H. was excited. He had the oil deal to end all deals. And he was no child when it came to such oil deals. It was a good deal. Mr. H. believed in its success for he had unbounded faith and optimism in his own ability to make it come out as he had planned. He had everything ready for us, and we could hardly keep him from signing right there and then.

We tried to slow him down, but he had the bit between his teeth and he was on the run. Finally we got him to listen, and we explained his deal to him from our point of view. We showed him the dangerous position he was needlessly putting himself in. Our faith in him was high, but we couldn't see a man put a noose around his own neck.

So we knocked off a lot of what he would have had to do. We brought his part down to what you could reasonably expect a man to do. We didn't lend him as much as he had wanted, but what we did lend him was fully adequate and on terms a great deal easier and more favorable to him than he had set up for himself.

We can do things like that because we know the oil business and we know the money business. Our advice is impartial and is based on a great deal of experience. So the chances are we can help you, too. That's why oil men ***going up*** come to the Oil Loan Department of The National Bank of Commerce.

E. O. BUCK, VICE PRESIDENT, OIL LOAN DEPARTMENT

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Facilities of the Oil Loan Department of The National Bank of Commerce are available in Wyoming, Colorado, Nebraska, New Mexico, Texas, Louisiana, and Mississippi.

U. S. Wells Completed in August and First Eight Months, 1954.

STATE or DISTRICT	NEW WELLS COMPLETED AND FOOTAGE DRILLED											DETAILS FOR JANUARY-AUGUST					Rigs in Operation		
								TOTAL NEW WELLS			Total Footage August, 1954	New Wells			Footage				
	Oil	Dist.	Gas	Dry	Water Input	Gas Input	Water Disposal	Aug., 1954	July, 1954	Aug., 1953		1954	1953	Percent Diff.	1954	1953	Aug. 31, 1954	July 31, 1954	Aug. 31, 1953
Alabama				5				5	5	11	25,717	53	70	— 24.3	275,980	362,623	5	4	8
Arizona												8	6	+ 33.3	30,774	19,960	5	4	3
Arkansas	23			34				57	46	48	193,451	372	313	+ 18.8	1,324,368	1,113,819	40	35	51
California	134		2	67				203	177	246	897,151	1,654	1,726	— 4.2	7,549,854	7,481,180	197	201	257
Colorado	32	1	6	81				120	112	88	647,590	862	450	+ 91.6	4,752,236	2,288,936	70	62	46
Florida				5				5	4	3	28,920	24	23	+ 4.3	150,755	135,017	3	4	5
Georgia									4	1		7	4	+ 75.0	18,008	9,748			4
Idaho													4	—100.0		22,748			1
Illinois	146			121				267	342	217	653,454	1,997	1,274	+ 56.8	5,275,385	3,155,859	288	265	234
Indiana	32			45				77	55	116	118,610	522	861	— 39.4	804,804	1,472,588	117	126	179
Kansas	190		18	137			2	347	421	436	1,264,126	2,796	3,128	— 10.7	9,854,030	10,824,186	392	411	452
Kentucky	52		16	57				125	123	130	228,275	920	766	+ 20.1	1,729,380	1,508,690	78	85	103
Louisiana	218	27	27	86				358	289	224	2,093,365	2,332	1,627	+ 43.3	14,625,875	11,696,955	272	276	247
North Louisiana	146	6	7	37				196	154	91	568,755	1,213	689	+ 76.1	3,549,529	2,564,322	57	57	59
South Louisiana	72	21	20	49				162	135	133	1,524,610	1,119	938	+ 19.3	11,076,346	9,132,633	215	219	188
Maryland										2			4	—100.0		15,614	4	4	1
Michigan	14		2	27			1	44	38	67	114,455	362	398	— 9.1	949,379	1,043,247	111	101	100
Mississippi	19	2		25				46	33	31	319,981	272	258	+ 5.4	1,924,995	1,790,301	45	28	39
Missouri				1				1	2	2	436	9	17	— 47.1	9,531	14,393	2		
Montana	10			19				29	12	26	124,682	223	262	— 14.9	878,983	1,203,042	38	44	72
Nebraska	25		1	31				57	33	25	305,260	273	222	+ 23.0	1,510,607	1,149,443	20	31	21
Nevada				2				2		1	11,123	10	7	+ 42.9	51,218	10,515	2	2	1
New Mexico	41		24	20				85	152	110	394,701	780	961	— 18.9	4,171,066	5,468,070	119	115	208
New York	27				16			43	50	94	58,769	408	611	— 33.2	599,627	853,779	69	71	115
North Carolina										1			1			1,570			
North Dakota	9		5	13				27	33	26	183,635	183	164	+ 11.6	1,268,460	1,254,513	28	34	29
Ohio	31		23	25				79	108	94	151,550	701	646	+ 8.5	1,359,928	1,316,941	196	209	187
Oklahoma	347		20	196			1	564	842	732	1,961,265	5,440	4,784	+ 13.7	18,498,783	16,878,773	678	748	568
Pennsylvania	17		12	6	12	5		52	66	161	96,053	688	1,085	— 36.6	1,217,367	1,879,550	148	161	290
South Dakota				1				1	1	6	3,929	16	14	+ 14.3	90,641	70,258	2	1	2
Texas	898	42	62	626	15	1		1,644	1,701	1,363	7,283,662	12,192	11,212	+ 8.8	55,039,794	51,404,860	1,227	1,301	1,226
Dist. 1: South Central	65			34				99	118	60	307,263	722	542	+ 33.2	2,425,892	1,779,087	31	43	27
Dist. 2: Middle Gulf	18	9		37				64	66	66	383,036	538	520	+ 3.5	3,219,930	3,235,162	35	45	43
Dist. 3: Upper Gulf	79	6	5	65				155	168	118	1,028,565	1,178	1,089	+ 8.2	7,990,397	7,369,607	116	123	124
Dist. 4: Lower Gulf-S.W.	39	11	2	60				112	135	166	616,850	987	1,246	— 20.8	5,130,525	7,182,640	72	80	79
Dist. 5: East Central	7			19				26	25	18	119,954	188	199	— 5.5	715,444	793,105	13	14	11
Dist. 6: Northeast	19	10	3	21				53	59	35	306,108	472	324	+ 45.7	2,792,331	1,922,420	60	53	42
Dist. 7-B: North Central	141	1	7	138				287	333	252	920,986	1,922	2,074	— 7.3	6,238,636	6,769,583	134	123	156
Dist. 7-C: West Central	63	2	2	55				122	97	110	645,813	861	930	— 7.4	4,430,239	4,592,116	120	126	121
Dist. 8: West	214	1	1	51	1			268	249	196	1,608,650	1,894	1,488	+ 27.3	11,403,473	8,523,024	338	344	325
Dist. 9: North	195	2	2	137	14	1		351	384	280	1,004,404	2,761	2,461	+ 12.2	8,484,903	8,186,920	236	266	215
Dist. 10: Panhandle	58		40	9				107	67	62	342,033	669	339	+ 97.3	2,208,024	1,051,196	72	84	83
Utah			1	5				6	6	5	33,119	36	55	— 34.6	178,046	307,312	23	22	19
Washington																	1	1	1
West Virginia	2		28	9				39	57	66	103,810	342	420	— 18.6	976,282	1,182,986	170	172	209
Wyoming	55		3	29				87	80	83	486,547	810	498	+ 62.7	4,309,370	2,517,990	89	98	119
Total United States	2,322	72	250	1,673	43	6	4	4,370	4,792	4,415	17,783,636	34,292	31,871	+ 7.6	139,425,526	128,455,466	4,439	4,616	4,797
Total Western Canada	116		42	100	1			259	223	170	997,932	1,387	1,444	— 4.0	5,517,094	5,946,290	109	176	199

Completions Remain High

Drilling rates through first 8 months hold substantial lead of the record rate of last year.

DRILLING RATES through the first eight months of this year held a substantial lead over the record set in the same period of 1953. This year a total of 34,292 new wells were completed, and that amounted to an increase of 7.6 percent over the 31,871 put into the records during the comparable period of last year.

Footage drilled in this year's wells totaled 139,425,526 feet and that amounted to a gain of 8.5 percent over the 128,455,466 feet drilled a year earlier. Showing that this year's drilling activity gain was even more pronounced than was indicated by the number of wells completed, was the fact that each new well was drilled to 4066 feet in depth this year as against an average of only 4030 feet in last year's eight months.

Although there are indications that drilling rates for the remainder of the year may ease somewhat, there seems to be good reason to believe that WORLD OIL's forecast of 50,264 new wells for 1954 will prove quite accurate. In order to reach that forecasted total, wells must average almost 4000 per month during the remaining four months. Last year, new wells totaled almost 4300 monthly during the final four-month period.

Such a final total of new wells drilled would not only make 1954 the most active drilling year of all-time, but it would mark the first year ever to record as many as 50,000, which has long been a dream of the U. S. industry.

Most of the top drilling states have seen operations increased this year over last year, and of the first five states only one has had a decline in activity. An 8.8 percent hike in drilling throughout Texas resulted in 12,912 wells being completed to keep that state far out in front of all others.

Oklahoma's 5440 wells represented a gain of 13.7 percent over last year's and were more than enough for second place in the nation.

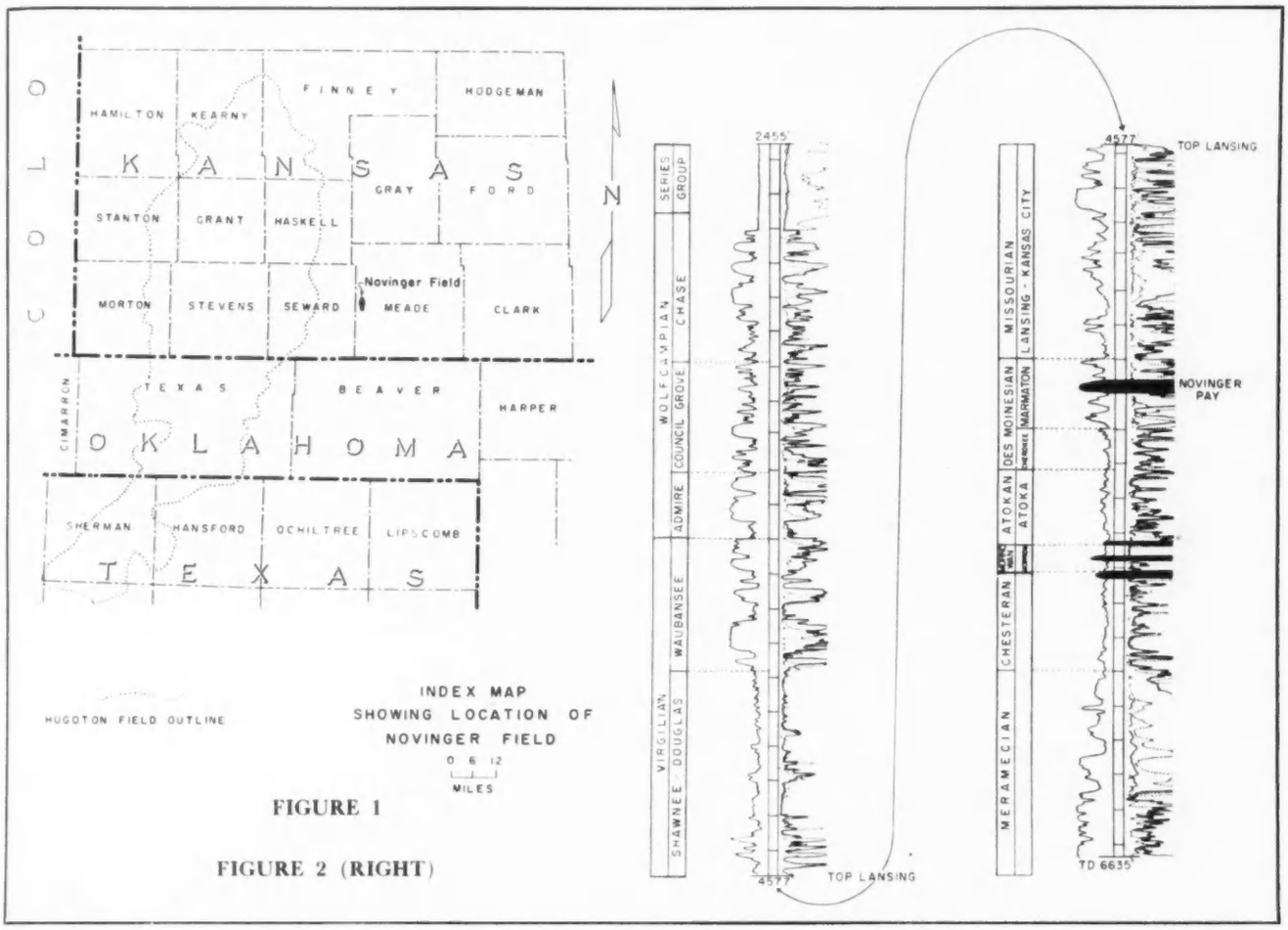


FIGURE 1

FIGURE 2 (RIGHT)

New Kansas Pool May Mean More Reef-Like Fields

The Novinger field is a reef-type limestone reservoir and an understanding of its peculiarities should help operators find similar oil accumulations.

By CHARLES A. RENFROE, Division Geologist,
Columbian Fuel Corporation, Amarillo, Texas

FOR THE PAST few years that part of the Anadarko Basin known as the Hugoton Embayment has been an area of intense interest to Mid-Continent oil operators. After the discovery of gas in the Chester by Stanolind on the Adams Ranch in Meade County, Kansas, and gas-distillate from Morrow sands in the Light pool of Seward County, Kansas, exploratory drilling was accelerated.

In the latter part of 1951, the Columbian Fuel and United Carbon T. B. Novinger 1, Sec. 26 33S 30W, Meade County, Kansas, discovered a substantial reserve of oil in a "reef-like" limestone body of Marmaton age. This was named the Novinger Field.

From the beginning it was recognized that the Novinger Field was a limestone reservoir with certain peculiarities that marked it as different from the usual Marmaton limestone reservoirs found in Kansas.

It has many features that are those of a bioherm. The constituent particles of the limestone are almost wholly organic. It has a ridge-like cross section; it is a linear mound-like circumscribed structure embedded in and surrounded by sediments of other lithologic nature; there is a draping of beds above the reservoir; the base of the pay shows a downward bending or saucer-shape characteristic of other sub-surface reefs.

From these criteria alone, one would be just as justified in calling the Novinger Field a reef as some similar bodies found in the sub-surface of West Texas that have been so designated. However, in one important aspect the Novinger Field producing formation departs from the accepted concept of a bioherm. There is no evidence whatsoever of sediment-binding organisms or colonial organic remains capable of forming a wave-breaking or potentially wave-breaking structure.

The Novinger producing formation is a clastic deposit formed by the deposition of organic fragments under turbulent conditions of waves and currents. It is no more a bioherm than would be a sand bar . . . as a matter of fact, the origin of a marine sand bar and deposits such as the Novinger zone would be very similar. The only

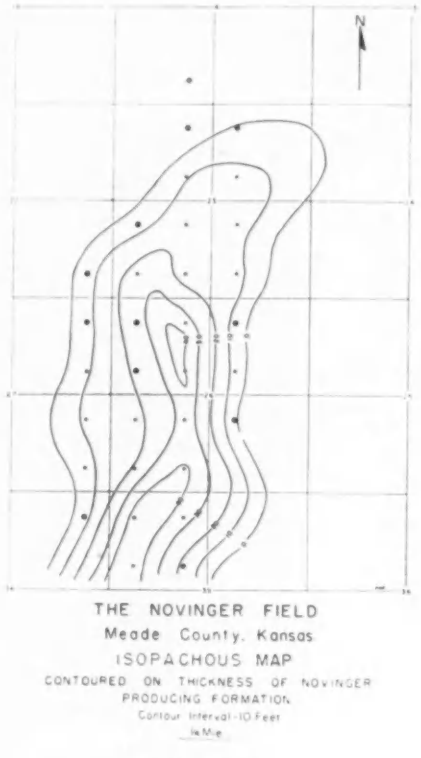


FIGURE 3

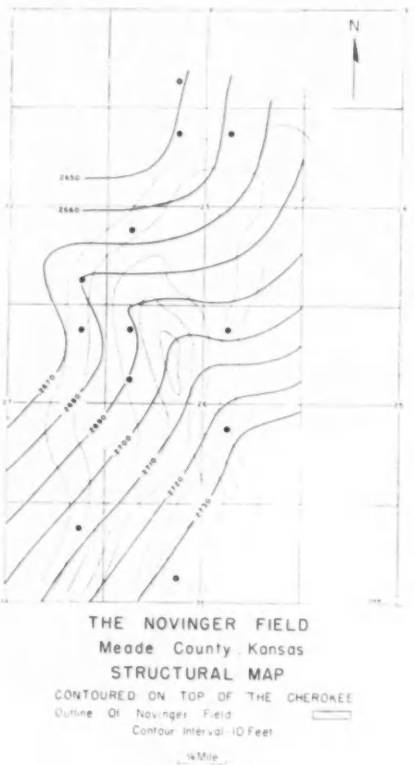


FIGURE 4

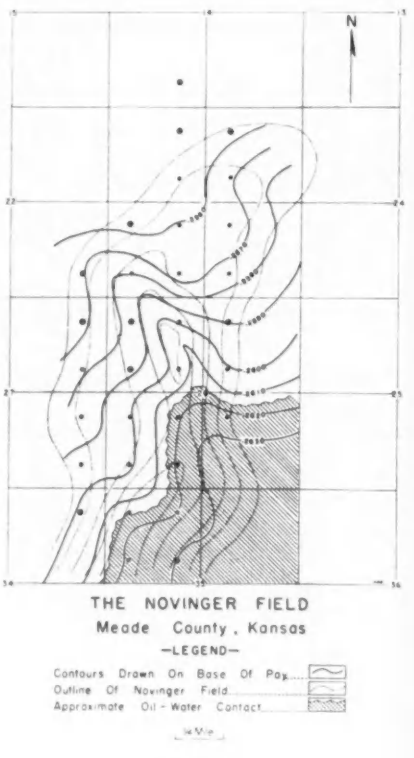


FIGURE 5

FIGURE 6

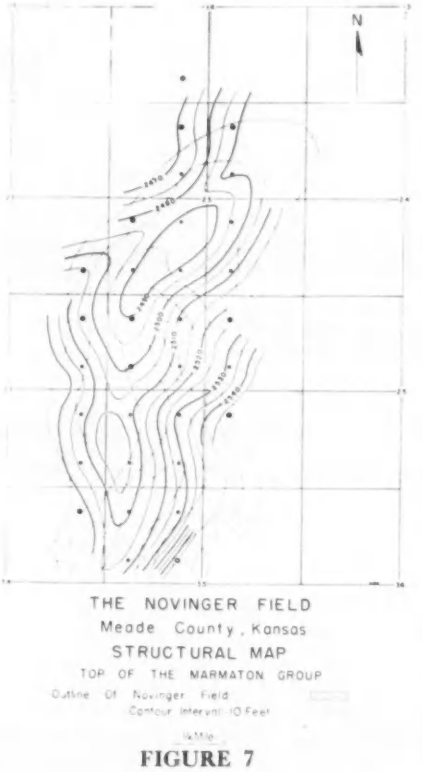


FIGURE 7

difference would be the availability of the material to be reworked.

Setting. The Novinger Field is within the Hugoton Embayment of the Anadarko Basin. Isopachous studies indicate that most of the structure now present in the immediate area of the Novinger Field was developed long after the deposition of the Marmaton formations. Although there is post-Mississippian pre-Pennsylvanian folding present in the Kismet Dome, some six miles to the west of the Novinger Field this feature was not positive during Marmaton times.

The central portion of the Hugoton Embayment was essentially static during this time. It was a broad, shallow, stable-shelf sea with little or no land-derived detritus. The closest highland may have been the Central Kansas Uplift which was partially emergent. The general stratigraphic relationship of the Des Moines in that direction was progressive marine onlap with locally developed unconformities and near the old shore line, development of cyclothemic deposition.

To the west the Des Moines changes facies near the Sierra Grande and Keyes Dome uplifts by grading into felspathic clastics with evidence of unconformity at the top of the section. To the south in Beaver County, Oklahoma, the Des Moines thickens rapidly in the direction of the axis of the Anadarko Basin and grades into arkoses on the flanks of the Amarillo Uplift.

Production Data. As of August, 1954, 37 wells had been drilled of which 31 produce from the Marmaton, 1 from the Chester, 2 from the Morrow sand, and 1 from a basal Atoka sand. Two dry holes have been drilled. From April, 1951, to August, 1954, the field produced approximately 900,000 barrels of oil. By far the largest amount of oil has been produced from the Marmaton.

Initial potentials on the Marmaton

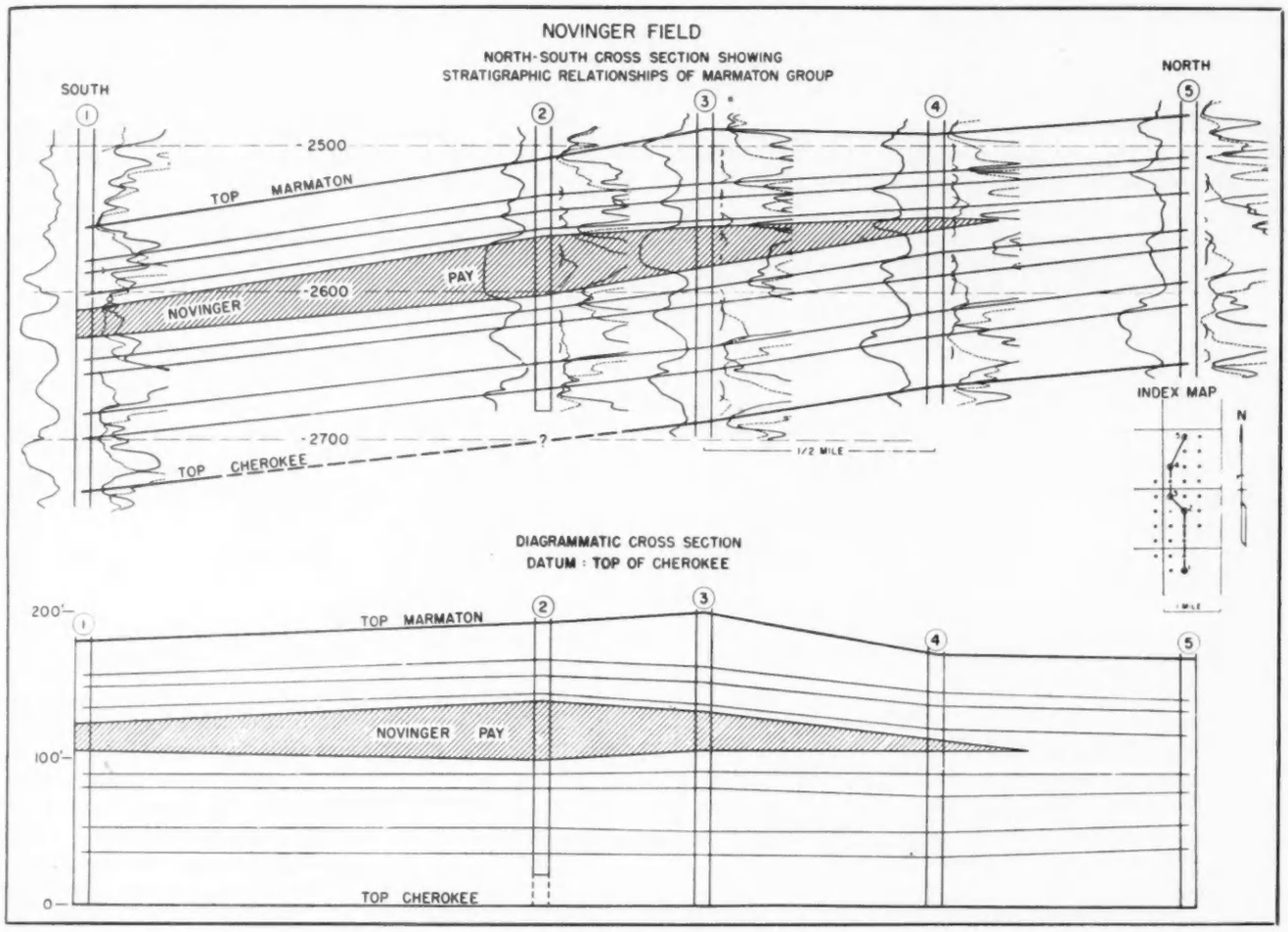


FIGURE 8

wells range from 114 to 2204 BOPD. The gas-oil ratio averages 550 to 1. Virgin bottom hole shut in pressure was approximately 1700 pounds. The oil produced from the Marmaton is a high gravity (40° API) paraffin base crude with a high pour point—it will congeal at 65°. Of the 31 Marmaton wells, 12 produce by flowing, and the remainder are on the pump. Most of the flowing wells are aligned along the central and thickest part of the Novinger pay (Figure 3).

The axial length of the field is more than 2½ miles, and its width is slightly less than a mile. The northern limits of the field have been delimited by three wells in which the Marmaton porosity was entirely lacking. Fortunately, two of these wells had sufficient porosity in Morrow sands to be completed as high G.O.R. oil wells. In the southern part of the field the Novinger zone is considerably thicker, but completions are complicated by edge water.

Average depth of the Marmaton pay is 5300 feet. Wells are drilled to total depth by rotary tools, and a 5½-inch production string is set through the pay. Final completion is done by a cable tool unit.

Stratigraphy. Figure 2 is a type electric log showing the typical stratigraphic sequence drilled in the Novinger Field. The Wolfcampian and Virgilian section is in general a limestone-shale sequence similar in most respects to the same section found elsewhere in Kansas. No shows have been found in these rocks in the Novinger Field. The Lansing-Kansas City is predominately limestone with considerable lateral variation. Some of the oolitic limestones in this section have been drill stem tested but have always yielded salt water, occasionally slightly gas cut.

MARMATON GROUP: Is usually composed of dark shaly limestones and shales with a few thin beds of oolitic limestone near the top. The thickness of this unit is remarkably constant in Meade and Seward counties except in a few areas where reef-like bodies are developed. The Novinger Field is one of those areas. Within the field the maximum thickness of the Marmaton Group is 200 feet, while in all of the surrounding wells the thickness is about 160 feet. The thickening of Marmaton Group in the Novinger Field is a result of expansion of the interval occupied by the Novinger producing formation.

ATOKA: There is no visible evidence of an unconformity between the Cherokee and the Atoka. The similarity between the rocks of the Cherokee and the Atoka suggest that the two are essentially the same lithic unit and that sedimentation continued uninterrupted from Des Moines to Atokan times. At the base of the Atoka there is a definite break in the lithologic sequence usually marked by some sort of detrital zone. In a few wells this break is marked by a channel type sandstone that may be gas bearing if sufficiently porous.

MORROW: The Morrow is a highly variable sequence of shales, silts, sandy limestones, and lenticular glauconitic sands that are productive when sufficiently porous. Thin coal seams are in the Morrow and indicate proximity of nearby highlands.

CHESTER: The Chester is a complex sequence of crinoidal limestones and marine shales. Chester production

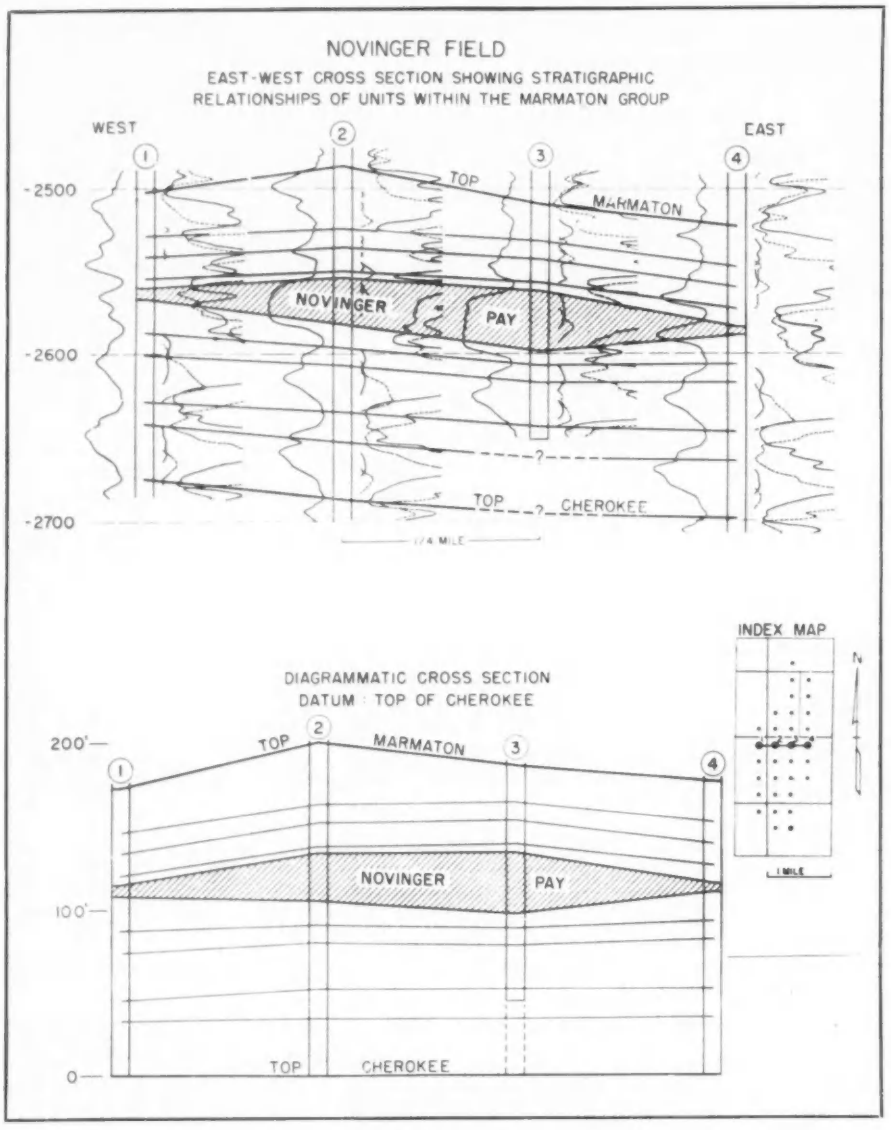


FIGURE 9

in the Novinger Field is from porosity developed in crystalline limestones at or near the Mississippian-Pennsylvanian plane of unconformity.

Character of Novinger Producing Formation. As can be seen in Figure 3, the general shape of the Novinger reservoir is an arcuate north-south trending body with a ridge-like cross-section. Within the contours of the isopachous map is present a moderately thick deposit of porous, oolitic, fragmental limestone. In all directions except south it grades into a thinner non-porous section of limy shales and lithographic limestone.

Shown in Figure 10 are typical core specimens from the Marmaton producing formation. These specimens illustrate the type of inclined bedding present in the Novinger pay. This bedding is apparently cross-bedding, since within the limits of a few feet of core the direction of dip may change radically. Cross bedding is not present throughout the entire section of the pay zone but may occur on any level. Cross bedding has been found in all of the wells drilled in the thickest part of the pay zone.

Most of the material of the cores are oolites. Mixed with the oolites are numerous foraminifera including abundant fusulines, echinoid spines, rounded and lime-coated shell fragments, and other fossil debris. The greatest majority of the oolites, when seen in this section, are ovoid masses that show neither concentric nor radial structure. When examined under polarized light, no type of nuclei was present. The writer believes these ovoid bodies to be algal in origin. Some of the inclined beds were coquinoid material composed almost entirely of shell fragments.

This type of deposit and this type of bedding suggests clastic material deposited by waves or currents. There is no evidence of any sort of colonial organism in any of the Novinger cores.

Porosity appears to be in part primary and in part secondary. The best porosity is usually associated with oolitic zones where the individual ooliths have been removed either partially or wholly by secondary solution.

Local Structure. Perhaps one of the most confusing aspects of the Novinger Field is the radical difference between structural maps drawn on beds below the Novinger pay zone and those drawn on horizons above the pay. This apparent divergence is due to the draping of the upper beds over the relatively rigid mass of the Novinger pay.

Figure 4 shows the Novinger Field contoured on top of the Cherokee which is one of the best datums to map on in this area. The Cherokee contours show a regional dip to the southeast with a local downwarping trending northwest through the center of the field. It is obvious that there is no association of the Novinger Field trend with structure on the Cherokee.

Figure 5 shows a structural map on the base of the pay which is quite similar to the Cherokee structural map. This map also shows that part of the field in which water is present. Presence of water is controlled by hydrostatic adjustments after tilting of the north-south trending Novinger reservoir to the southeast. The oil-water contact in the Novinger Field is a ragged zone rather than a plane. The degree of encroachment seems to be dependent on the permeability of the beds. Since the permeability is rather uneven, it is possible for water to move further updip in the permeable strata than in the tighter beds.

Figure 6 shows a structural map contoured on top of the Novinger pay. Here there is a radical change from the contour maps drawn on pre-Marmaton horizons. There is now a north-south alignment with a southward plunging nose and a closed high. This same trend is repeated on structural maps drawn on top of the Marmaton Group (Figure 7). This same general north-south nosing can be shown to exist well up into the Kansas City group. In the Lansing there is still some rather ill-defined nosing

Continued on Page 120

Oil and More Gas Promised In Northern Arkansas

• **Gas production encourages exploration in the Arkansas Valley.**

• **Mississippi Embayment offers possibilities of oil in Tertiary and Upper Cretaceous sediments.**

By B. J. SCULL, Geologist,
Arkansas Resources and Development Commission, Little Rock

Exploration Methods.

Surface—Most of the companies holding appreciable leases in northern Arkansas have done considerable surface mapping.

The methods used vary quite a bit. Aerial photographs as base maps are used by most parties but some use only plane table methods. Parties using photos without plane table control may make dip-strike maps or may establish altimeter control and contour the base of the Hartshorne sandstone or various semi-continuous sandstones in the Atoka. Coal beds are not satisfactory mapping horizons because they are for the most part present only in the synclines.

Geophysical—Seismic, gravimetric and airborne magnetometer surveys have been made by various companies in the Arkansas Valley and in the Embayment. As yet no data as to the effectiveness of any method has been released. Seismic exploration should be fairly reliable after velocity surveys are obtained from some of the wells that penetrate the pre-Pennsylvanian formations. Airborne magnetometers should show axial shift of some of the larger structures. In the southern part of the valley, igneous dikes may cause difficulty in making the necessary corrections for reliable interpretation. Gravity meter surveys should be effective in finding basement highs, but the thick shale and sand sections in the southern part of the Arkansas Valley may make definition of local structures difficult.

Drilling—Some of the companies operating in northern Arkansas are using core drills to establish subsurface control. Most of the coring activity is in the Embayment area, but some is being done in the Arkansas Valley.

Several wildcat wells have been drilled in the Arkansas Valley in the last two years, and several more will be drilled by the end of 1954.

This prospective drilling campaign will add much stratigraphic information and will test many of the more favorable appearing structures in the valley.

The Ozark-Ouachita Facies Change. Only two wells have been located so as to drill through beds that represent both Ozark and Ouachita elements. They are the Residue Company Mansfield Gas 1 in Sect. 6-4n-30w and Lion Oil Company Nalley 1 in Sect. 33-8n-7w.

The Residue well was drilled on the Mansfield dome on the Hartford anticline. There is no general agreement among geologists working in the Arkansas Valley as to the correlation of strata penetrated by this well. The well is located in a topographic basin over 3000 feet below the top of the Atoka. The writer believes that the sand zone from 5900 to 6600 feet is stratigraphically equivalent to the basal Atoka sand zone in the Cecil Field and the Massard Prairie in Arkansas, and in the Spiro Field in Oklahoma. Two feet of pebbly conglomerate at a depth of 7128-30 feet is considered to be the base of the Atoka formation.

Therefore, the Atoka is over 10,000 feet thick at this locality. There is no evidence of repetition of section by faulting. Beneath the conglomerate is 1400 feet of shale that is equivalent to the "Johns Valley"-Wapanucka sections of Oklahoma and the Bloyd shale in the Ozarks. A slightly calcareous sandstone topped at 8620 feet is correlated with the Cromwell of Oklahoma and the Hale of the Ozark area. These correlations are tentative. Much more detailed surface and subsurface data must be obtained before their validity can be tested.

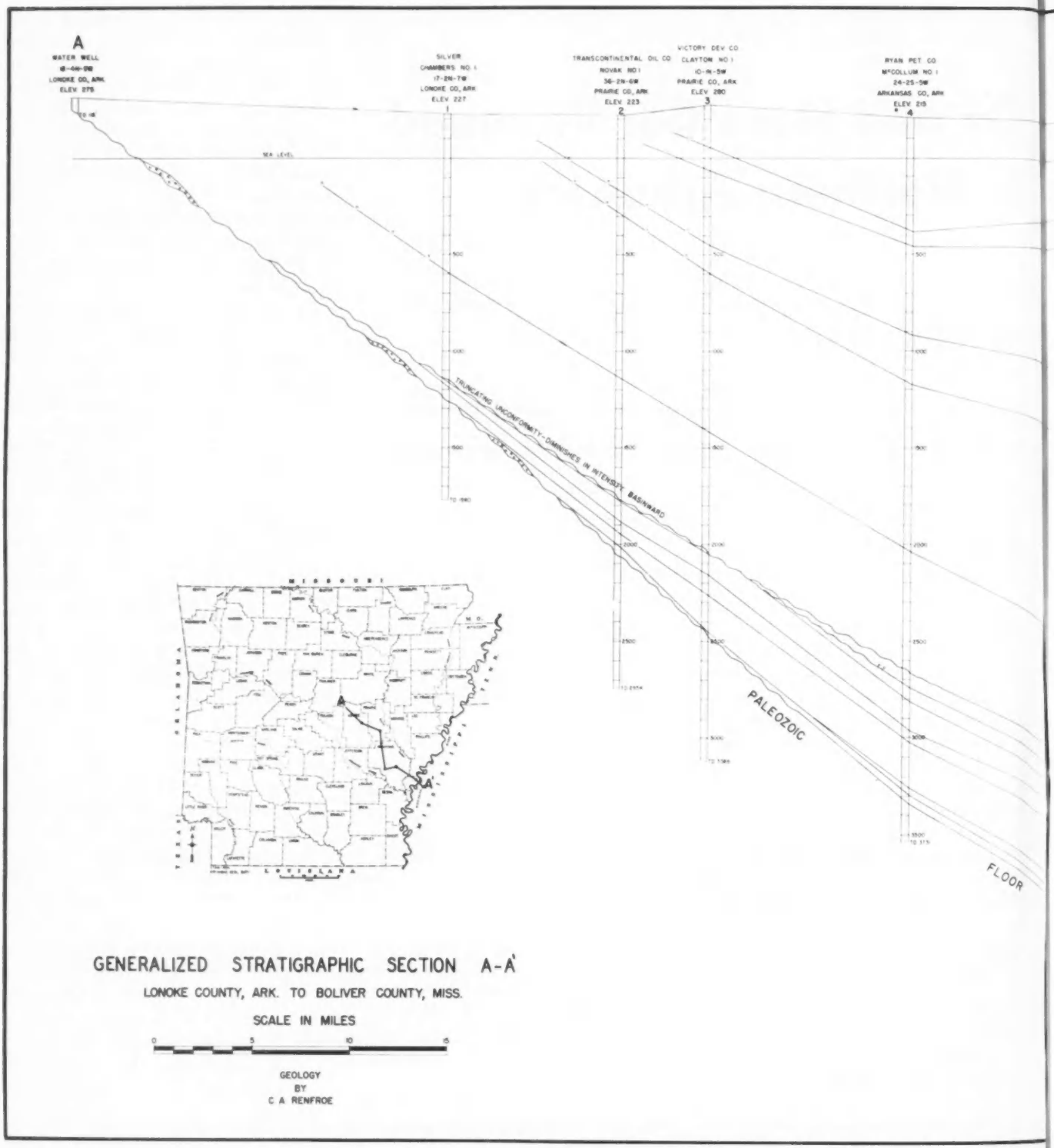
The Lion well was drilled on the Searcy anticline. The well spudded into the Atoka formation and encountered Morrow at a depth of 1100 feet. The Morrow beds in this well are in the transition zone between the Bloyd and Hale of the Ozarks and the upper Morrow shales and the Jackfork sandstones of the Ouachitas. In the well the Morrow beds are about 1400 feet thick as compared to 500 to 600 feet in the Ozarks and 5000 to 6000 feet in the Ouachitas.

Beneath the Morrow is 3000 feet of shale with siltstone and sandstone stringers and beds that, on lithology, would prompt a southern Oklahoma geologist to call the section the Goddard-Caney section. This section represents the transition zone between the various Mississippian formations in the Ozarks and the Stanley shale in the Ouachitas. The Mississippian section averages about 700 feet thick in the Ozark-Arkansas Valley region and about 5000 feet in the Ouachitas. Below the Mississippian rocks is a normal Ozark section.

Future Possibilities

Ozark Platform—The shallow gas fields in the southern part of the Ozark Platform will be expanded and new gas fields will be developed, particu-

Part 2



GENERALIZED STRATIGRAPHIC SECTION A-A'

LONOKE COUNTY, ARK. TO BOLIVER COUNTY, MISS.

SCALE IN MILES

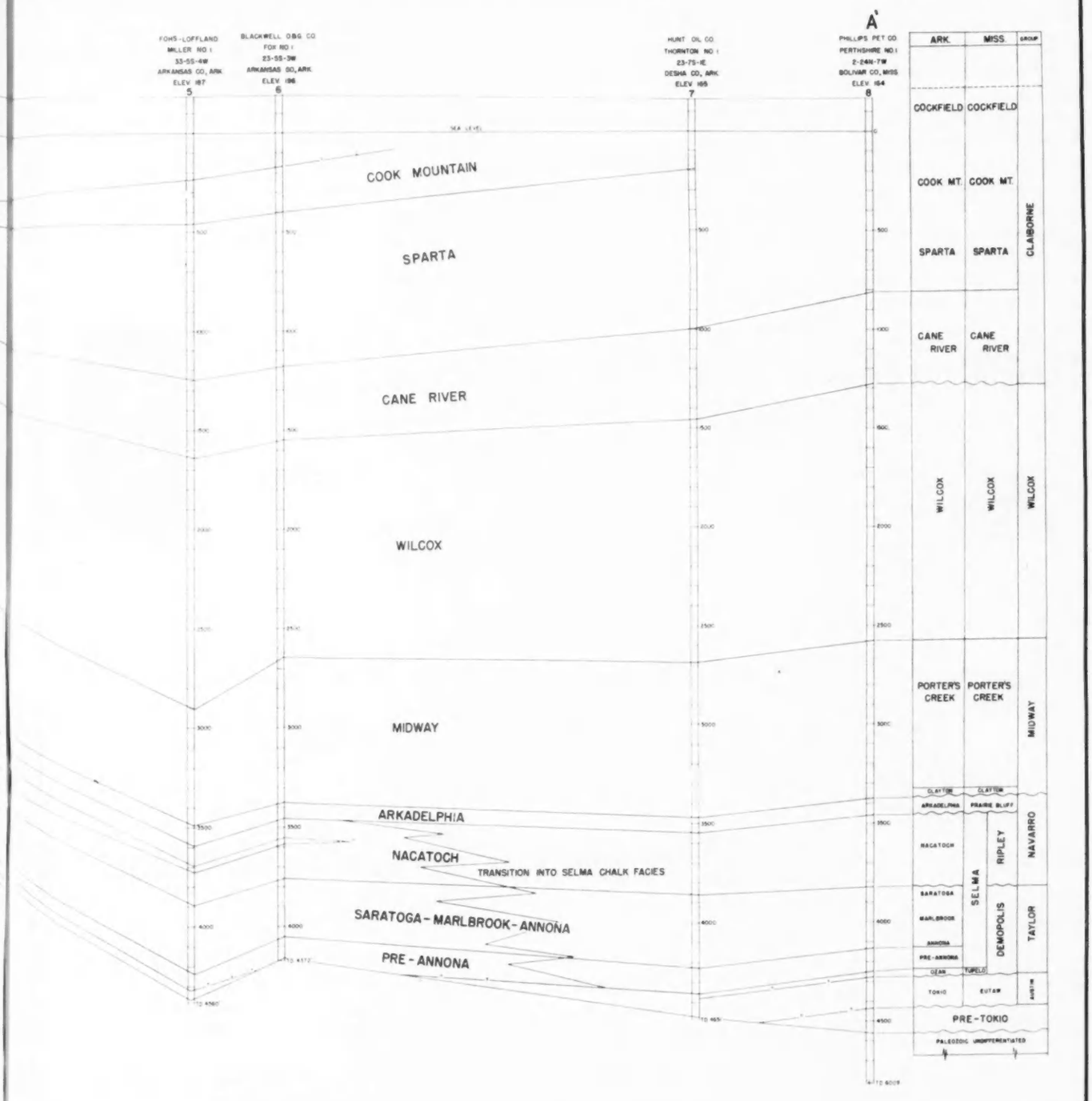
0 5 10 15

GEOLOGY
BY
C A RENFROE

larly from the Mississippian section. However, large reserves of gas in any one field would be surprising. With present information, the Ozark area is the most favorable in northern Arkansas for finding oil. Several of the sands in the section have oil seeps on their outcrops. The writer believes the most likely traps would be in closure on the downthrown side of normal faults. The drilling depths (600 to 3000 feet) make the area attractive even though the potential reservoirs will not be large.

Arkansas Valley—The large increase in natural gas reserves in the western part of the valley area in the last few years has accelerated leasing and wildcat drilling. Anticlinal structures in the central and eastern parts of the valley must be tested, not only the Pennsylvanian beds but the Mississippian and older, before the future prospects can be evaluated. Subsurface geology and geophysics must be used to determine axial shift, pre-Atoka faulting, extent and degree of unconformities and facies changes in order to conduct a satisfactory wildcatting program.

The gas recovered from the Atoka and Hale formations is dry, 96+ percent methane. This is not encouraging for oil possibilities. However, the pre-Pennsylvanian section is similar to the pre-Pennsylvanian of Oklahoma, so



the possibilities of oil are good if suitable traps, permeability and porosity are present.

Ouachita Mountains—The Ouachita Mountains in Arkansas are too much of a geological blank to be considered as a potential oil or gas province. High dips, thick shale sections and poorly known structural conditions are not encouraging. If the Arkansas Valley proves to be favorable economically, then exploration efforts could be extended southward into the frontal Ouachitas.

Mississippi Embayment—The Embayment area seems to have all the requisites of an oil province but the oil. However, the systematic exploration methods being applied by the several companies operating in the area should lead to finding production. The most favorable types of traps should be strand line sands, sands on top of or on the margins of highs in the Paleozoic floor and local wrinkles near facies changes in the Tertiary and Cretaceous beds.

The buried Paleozoics may offer additional sources of oil and gas, but a better understanding of the Paleozoics in the eastern part of the Arkansas Valley is necessary before the Embayment area can be studied effectively.

—**The End**

New Kansas Pool May Mean More Reef-Like Fields

Continued from Page 116

present, but apparently, the effects of the Novinger reservoir have almost died out.

Cross-sections of the field (Figures 8 and 9) illustrate this expansion of the Marmaton interval across the field that was responsible for the difference in structure between the underlying and overlying beds. As can be seen on the cross sections, the stratigraphic relationships are much simplified when the Cherokee was used as a datum plane. This in effect restores the field to a position similar to its attitude at the time of deposition and removes the confusing elements of later folding.

Conclusions. The Novinger Field is a "reef type" limestone reservoir of organic debris, transported and deposited by waves and currents. It was developed on a stable-shelf area so far removed from any highlands that it was dominantly an area of carbonate deposition. The constituent material of this deposit behaved dynamically as clastic particles. Such deposits have been called "reefs" and bioherms. Such bodies as this could be named more properly "bioclastic banks." There should be some differentiation between this type of deposit and true reef structures such as Capitan and Leduc.

Distribution of such banks or bars will be random and sporadic, as the circumstances that control their development will be such factors as depth limitation, salinity, turbidity, currents, direction of prevailing winds, hydrogen ion concentration and other unmappable causes. But from what we know now there is no reason why there should not be other such fields in the Hugoton Embayment. In those areas of the Mid-Continent where stable shelf-type carbonate deposits were laid down during Pennsylvanian times there was considerable lateral variation in the types of limestone. While admittedly difficult, it is the study of these variations that will enable us to find more oil in western Kansas.

—**The End**

About the Author

CHARLES A. RENFROE, division geologist for Columbian Fuel Corporation at Amarillo, Texas, was born at Plainview, Texas, in 1912. He received his B.S. degree from Texas Technological College and an M.S. degree from the University of Oklahoma. He taught geology at both Texas Tech and Oklahoma. He has worked for Phillips Petroleum Company, Superior Oil Company, and the Arkansas State Geological Survey as a petroleum geologist. He has been with Columbian for the past three years and has been active in the development of the Novinger Field since the drilling of the discovery well.

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State or District	MONTH OF AUGUST, 1954													FIRST EIGHT MONTHS, 1954																
	Productive Tests									Total Productive	Unproductive Tests			Total Exploratory Tests	Productive Tests								Total Productive		Unproductive Tests			Total Dry		Total Exploratory Tests	
	New Fields			New Pays			Extensions								New Fields			New Pays			Extensions									
	Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas		Wildcats	New Pays	Outposts		Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas	8 Mo. 1954	8 Mo. 1953	Wildcats	New Pays	Outposts	8 Mo. 1954	8 Mo. 1953	8 Mo. 1954	8 Mo. 1953
Alabama											4			4												45			45	53	45	53
Arizona																										8			8	6	8	6
Arkansas											16			16	2		1	2		1	1			7	22	67		4	71	81	78	103
California				2					1	3	44			47	12		2	6		1	3		2	26	56	228		2	230	309	256	365
Colorado	1	1	1	1		1				5	58		2	65	30	4	11	2		1	1		1	50	31	333		6	339	198	389	229
Florida											5			5	1									1		22			22	23	23	23
Georgia																										7			7	4	7	4
Idaho											1			1												1			1	4	1	4
Illinois	1			1			4			6	58			64	17			19			39			75	55	394			394	298	469	353
Indiana											21			21	8		2							10	28	160			160	237	170	265
Kansas	12		1							13	60			73	71		14	4		1	4		1	95	119	502		1	503	607	598	726
Kentucky	1									1	5			6	21									21	18	33			33	73	54	91
Louisiana	1	3	2	4	6				1	17	36		4	57	22	17	13	31	26	8	1	2	2	122	91	251		12	263	253	385	344
North Louisiana			1		1					2	17		1	20	4	1	3	5	2	3				18	20	94		2	96	125	114	145
South Louisiana	1	3	1	4	5				1	15	19		3	37	18	16	10	26	24	5	1	2	2	104	71	157		10	167	128	271	199
Michigan	1									1	9			10	9						1			10	15	141			141	163	151	178
Mississippi	1									1	17		1	19	3							1		4	20	105		4	109	137	113	157
Missouri																										6			6	8	6	8
Montana							1			1	14			15	4		1	2			1			8	10	60			60	56	68	66
Nebraska	2									2	24		1	27	15		3	1			3			22	21	88		2	90	100	112	121
Nevada											2			2	1									1		9			9	8	10	8
New Mexico	1		3	1			1			6	13			19	12		29	4	2		6			53	38	113		1	114	92	167	130
North Carolina																														1		6
North Dakota											13			13	1			1			2			4	9	74			74	38	78	40
Ohio											2			2							3		3	6	4	9			9	12	15	11
Oklahoma	10			3			1			14	61			75	74	8	13	19	1	1	46	2	2	166	167	477			477	483	643	657
Pennsylvania																									1						1
South Dakota											1			1	1									1		10			10	14	11	14
Texas	48	6	12	31	3	1	5			106	383		6	495	372	53	68	163	41	15	73	10	12	807	794	2797		43	2840	2847	3647	3641
Dist. 1 S. Central	1						1			2	32			34	19	2	5	1	1	1	7	2	2	40	22	194		1	195	216	235	238
Dist. 2 Middle Gulf					1					1	29		1	31	5	8	11	3	3	2	3	1	2	38	51	182		4	186	190	224	241
Dist. 3 Upper Gulf		1	2	8	1					12	38		4	54	15	9	4	49	17	4	1			99	113	272		26	298	283	397	396
Dist. 4 L. Gulf-S.W.	2	2	1	6		1				12	34			46	16	19	3	34	15	4	2	5	2	100	142	251		5	256	321	356	463
Dist. 5 E. Central	2									2	14			16	2			1			1			4	7	96			96	82	100	89
Dist. 6 Northeast				2	1					3	16			19	2	2	1	2	2					9	14	107		2	109	96	118	110
Dist. 7-B N. Cent.	16	1	6	7						30	86		1	117	118	1	23	18			8		2	170	165	591		2	593	640	763	805
Dist. 7-C W. Cent.	6	1	2	1			1			11	43			54	34	4	8	7	1	1	7		1	63	70	246		1	247	234	310	304
Dist. 8 West	9			4			3			16	33			49	71	2	3	24	1	2	35	1	1	140	86	276		1	277	248	417	334
Dist. 9 North	12	1		3						16	53			69	88	4	3	23			9		1	128	122	541		1	542	532	670	654
Dist. 10 Panhandle			1							1	5			6	2	2	7	1	1	1		1	1	16	2	41			41	5	57	7
Utah											3			3	2		2							4	9	21			21	31	25	40
West Virginia																															
Wyoming	1		2							3	21			24	48		4	7			3			62	19	138			138	80	200	99
Total U. S.	80	10	21	43	9	2	12		2	179	871		14	1064	726	82	163	261	70	28	187	15	23	1555	1527	6099		75	6174	6216	7729	7743

Exploratory Trend Steady

This year's figures almost identical with '53.

By **CECIL W. SMITH,** WORLD OIL Staff

THERE HAS BEEN little change in exploratory drilling this year from last year's record-breaking operations. August's completed wells numbered just one more than those recorded in the same period of 1953, and the total drilled in eight months this year lacked only 14 tests of matching last year's eight-month total.

However, this year's hunt has been a bit more successful from a numerical standpoint. Slightly fewer tries resulted in slightly more producing wells. So far this year, 1555 exploratory attempts proved to be commercial producers, and they amounted to 20.1 percent of the total drilled. While a year earlier 1527 successes amounted to a slightly less 19.7 percent.

Rank wildcatting accounts for about 90 percent of total exploratory drilling, with the remaining 10 percent devoted to attempting to uncover new pay horizons in established fields or to extend their boundaries. Wells in the rank wildcat class were slightly more numerous this year compared with last year's activity, and also a little more successful.

A total of 7070 rank wildcats was completed through August, resulting in the discovery of 971 new producing fields. A year earlier, 7004 were drilled and they opened 901 new areas. Numerically, this year's results amounted to 13.7 percent of the total drilled, while last year's success factor was 12.9 percent.

Summary of Results of Exploratory Drilling

ITEM	Aug., 1954	July, 1954	EIGHT MONTHS January-August 1954	1953	Percent Diff.
Oil Discoveries	**123**	**131**	**987**	**950**	**+ 3.9**
New Fields	80	97	726	685	+ 6.0
New Pays	43	34	261	265	— 1.5
Distillate Discoveries	**19**	**21**	**152**	**111**	**+ 36.9**
New Fields	10	10	82	69	+ 18.8
New Pays	9	11	70	42	+ 66.7
Gas Discoveries	**23**	**34**	**191**	**180**	**+ 6.1**
New Fields	21	30	163	147	+ 10.9
New Pays	2	4	28	33	— 15.2
Total Discoveries	**165**	**186**	**1330**	**1241**	**+ 7.7**
Extensions to Fields	**14**	**27**	**225**	**286**	**— 21.3**
Oil Fields	12	24	187	231	— 19.0
Distillate Fields		1	15	22	— 31.8
Gas Fields	2	2	23	33	— 30.3
Total Prod. Tests	**179**	**213**	**1555**	**1527**	**+ 1.8**
Dry Holes	**885**	**873**	**6174**	**6216**	**— 0.7**
Wildcats	871	865	6099	6103	— 0.1
New Pays				1	
Outposts	14	8	75	112	— 33.0
Total Expl'tory Tests	**1064**	**1086**	**7729**	**7743**	**— 0.2**
Percent Productive	16.8	19.6	20.1	19.7	
Percent Dry	83.2	80.4	79.9	80.3	

U. S. Discoveries in August

NEW FIELDS, NEW PAYS AND EXTENSIONS

CALIFORNIA—NEW OIL PAYS

Fresno County, Coalinga, East field. Shell Oil Co.'s "27" 536X, in 27-19s-15e, pumped 19 barrels from Etchegoin sand, Pliocene 503-665 feet, completed 8-18-54, TD 690.

Ventura County, Unnamed field. Lloyd Corporation Ltd's W. R. Livingston 1, 31-2n-21w, Old Well Worked Over, flowed 236 barrels from 9265-9560 feet, 8/64-inch, completed 8-6-54, TD 10024.

CALIFORNIA—GAS FIELD EXTENSION

San Joaquin County, Galt field. Artnell Oil & Gas Co., Inc.'s Grussendorf 1, in 7-4n-7e, 1¼-mile southeast extension, flowed 35 barrels water and 0.7 million from Nortonville shale, Eocene 2346-49 feet, 3/16-inch, completed 8-20-54, TD 2810.

COLORADO—NEW OIL FIELD

Moffat County. The Texas Co.'s Government-Treleaven 1, NE SW SW 32-5n-95w, pumped 323 barrels from Morrison lime, Jurassic 6552-58 and 6625-47 feet, 32.2-gravity, completed 8-8-54, TD 6819.

COLORADO—NEW OIL PAY

Logan County, Padroni field. British-American Oil Producing Co.'s Hamil 1, C SE SE 19-9n-52w, pumped 105 barrels oil and 293 barrels water from "J" sand, Upper Cretaceous 4689-95 feet, completed 7-19-54, TD 4827.

COLORADO—NEW DISTILLATE FIELD

Washington County. Virgil O. King & James F. Smith's Windolph 1, SW SW SE 20-2n-54w, flowed 36 barrels oil and 3.0 million from "D" sand, Upper Cretaceous 4836-48 feet, 14/64-inch, completed 5-12-54, TD 4853.

COLORADO—NEW GAS FIELD

Washington County, Xenia field. Claycomb & Guida & New Drilling Co.'s Roedemister 1, C SE SE 13-2n-54w, flowed 4.3 million from "D" sand, Upper Cretaceous 4755-60 feet, completed 8-20-54, TD 4895.

COLORADO—NEW GAS PAY

Logan County, Springdale field. Shell Oil Co.'s State B-2, NW NW SE 16-8n-53w, flowed 1.3 million from "D" sand, Upper Cretaceous 4870-82 feet, 18/64-inch, completed 8-2-54, TD 7755.

ILLINOIS—NEW OIL FIELD

Washington County, Dubois-Central field. Ohio Oil Co.'s Schwind Community 1, NE NW 33-3s-1w, pumped 144 barrels oil and 85 barrels water from Rosiclare sand, Mississippian 1522-31 feet, completed 8-10-54, TD 3100.

ILLINOIS—NEW OIL PAY

Edwards County, Ellery, North field. Illinois-Midcontinent Oil Co.'s Harris-Woods Community 1, NW NW NE 18-2s-10e, pumped 109 barrels from Bethel sand, Mississippian 3097-3132 feet and Aux Vases sand, Mississippian 3230-60 feet, completed 8-31-54, TD 3385.

ILLINOIS—OIL FIELD EXTENSIONS

Christian County, Mt. Auburn Consolidated field. H. F. Robison's J. Augur 1, NW SW NW 24-15n-2w, ¾-mile extension, pumped 97 barrels from Silurian lime, Silurian 1887-92 feet, completed 8-31-54, TD 1906.

Mt. Auburn Consolidated field. Shulman Bros. & Ohio Oil Co.'s G. Shepherd 1, NW NW SE 19-15n-1w, pumped 104 barrels oil and 10 barrels water from Silurian lime, Silurian 1896-1940 feet, completed 8-10-54, TD 1970.

Crawford County, Main field. J. G. Beard's Francis 1, NE NW SW 4-8n-12w, 1½-mile extension, pumped 40 barrels oil and 20 barrels water from Pennsylvania sand, Pennsylvanian 1116-29 feet, completed 8-24-54, TD 1515.

White County, Norris City field. E. F. Moran's Spence 1, SW NE NW 33-6s-8e, ½-mile extension, flowed 55 barrels from McClosky lime, Mississippian 3132-36 feet, completed 8-24-54, TD 3152.

KANSAS—NEW OIL FIELDS

Barton County, Jettie field. Phillips Petroleum Co.'s Jettie 1-A, SW SE NW 26-20s-14w, pumped 2565 barrels from Simpson sand, Ordovician 3534-40 feet, TD 3610.

Dickinson County, Ash Grove field. Don Ingling's Wilson 1-A, SW SW SW 5-15s-1e, pumped 20 barrels from Mississippi sand, Mississippian 2571-79 feet, 32-gravity, TD 2579.

Ellis County, Leiker, Southeast field. Frontier Oil Co.'s Witt 1, SW SW SE 14-15s-18w, pumped 160 barrels from Arbuckle lime, Ordovician 3547-51 feet, TD 3551.

Harper County, Banner field. Musgrove Petroleum Corp's Moldenhauer 1, SW SW SW 27-32s-7w, potentialed 3,000 barrels from Simpson sand, Ordovician 4833-39 feet, TD 5025.

Grabs, West field. Berwick Drilling & Aurora Gasoline Corp's Morris 1, SE SE SE 14-31s-9w, potentialed 921 barrels from Mississippi sand, Mississippian 4398-4404 feet, TD 4500.

Kingman County. Pickrell Drilling's Tjaden 1-B, NW NW SW 19-30s-7w, pumped 205 barrels from Mississippi dolomite, Mississippian 4210-40 feet, TD 4333.

Ness County, Aldrich, Northeast field. Barnett Oil Co.'s Shearer 1, SW SW SE 23-17s-25w, pumped 66 barrels from Mississippi dolomite, Mississippian 4399-4405 feet, TD 4405.

Pawnee County. Welch & Olsson's Klepper 1, NW NW NW 5-23s-17w, pumped 85 barrels from Misener sand, Mississippian 4242-46 feet, TD 4318.

Pratt County, Fitzsimmons, South field. Sterling Drilling Co. et al's Elliot 1, NW SW SE 31-27s-13w, potential 1,117 barrels from Arbuckle lime, Ordovician 4427-44 feet, TD 4527.

Stafford County. West-Pan Hydrocarbon's Curtis 1, NW NE NE 7-25s-13w, pumped 51 barrels from Kansas City lime, Pennsylvanian 3910-14 feet, TD 4300.

Mopac field. Cooperatin Refining Association's McMullen 1-A, SW NE NW 30-24s-11w, pumped 32 barrels from Viola lime, Ordovician 3908-20 feet, TD 4098.

Sutton field. Natural Gas & Oil Corp. & Amerada Petroleum Corp.'s Sutton 1-A, SW NE SW 21-22s-14w, pumped 66 barrels from Lansing lime, Pennsylvanian 3668-81 feet, TD 3999.

KANSAS—NEW GAS FIELD

Barber County. Imperial Drilling Co.'s Blunk 1, NE SW SW 5-34s-13w, flowed 2.5 million from Mississippi sand, Mississippian 4876-82 feet, TD 5515.

KENTUCKY—NEW OIL FIELD

Henderson County. F. H. Rhodes & Charles Morburger's Otto Chase 1, in 9-Q-26, pumped 124 barrels from Waltersburg sand, Mississippian 1269-70 feet, TD 1270.

NORTH LOUISIANA—NEW DISTILLATE PAY

Bossier Parish, Sentell field. Pan American Production Co.'s Rushing-Vance 1, in 32-20n-13w, flowed 18 barrels distillate and 0.8 million from Roseberry sand, Jurassic 9253-64 and 9268-72 feet, completed 8-7-54, TD 9335.

NORTH LOUISIANA—NEW GAS FIELD

Ouachita Parish. Carter Oil Co.'s J. H. Rhymes Heirs 1, in 26-17n-4e, flowed 5.3 million from Pettit lime, Lower Cretaceous 5296-5313 feet, 24/64-inch, and 54.5 million from Travis Peak sand, Lower Cretaceous 5507-20 feet, 20/64-inch, completed 8-5-54, TD 9536.

SOUTH LOUISIANA—NEW OIL FIELD

Plaquemines Parish, South Pass field, Block 27. Shell Oil Co.'s State Lease 1011-1, Gulf of Mexico, flowed 250 barrels from 7430-40 feet, 11/64-inch, 30-gravity, completed 8-30-54, TD 9918.

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SOUTH LOUISIANA—NEW OIL PAYS

Cameron Parish, Crab Lake field. Forest Oil Corp.'s Dr. M. O. Miller 3, in 29-15s-5w, flowed 337 barrels from 12,573-83 feet, 12/64-inch, 39.6-gravity, completed 8-27-54, TD 12,950.

Plaquemines Parish, Southeast Pass field. Humble O&R Co.'s State Lease 1927-22, in 18-23s-21e, flowed 156 barrels from 7534-44 feet, ⅛-inch, 34-gravity, completed 8-12-54, TD 8500.

St. Mary Parish, Charenton field. Fifteen Oil Co.'s South Coast Corp. 25, in 32-13s-10e, flowed 22 barrels from 6840-50 feet, 8/64-inch, 35-gravity, completed 7-30-54, TD 10,175.

Terrebonne Parish, Lirette field. Humble's Henry J. Ellender 6, in 32-19s-19e, flowed 366 barrels from 11,610-16 feet, ⅛-inch, 34.7-gravity, completed 8-11-54, TD 13,500.

SOUTH LOUISIANA—NEW DISTILLATE FIELDS

Acadia Parish. Hassie Hunt Trust's A. Commert 1, in 23-8s-12, ungauged from Lower Miocene, 10,818-28 feet, completed 7-16-54, TD 11,540.

Beauregard Parish. Texas Gulf Producing Co.'s W. J. Herpin 1, in 19-6s-8w, flowed 45 barrels distillate and 1.5 million from Cockfield sand, Eocene, 7275-80 feet, 11/64-inch, 56.7-gravity, completed 7-27-54, TD 7370.

Cameron Parish, Big Lake Area. Stanolind O&G Co.'s Walter Le Bleu Unit 6—1, in 11-12s-9w, ungauged from Lower Miocene, 10,224-30 feet, completed 7-3-54, TD 10,705.

SOUTH LOUISIANA—NEW DISTILLATE PAYS

Acadia Parish, Iota-East Flank field. Elge Rasberry's Lenore Lejune 3, in 19-8s-1w, flowed 121 barrels oil and 2.2 million from 9924-30 feet, 10/64-inch, 55-gravity, completed 8-3-54, TD 10,310.

Pine Bluff field. Forest Oil Corp.'s Ardras Pousson 1, in 19-9s-1w, flowed 27 barrels distillate and 8.2 million from 11,788-98 and 11,801-11 feet, 14/64-inch, 47-gravity, completed 8-5-54, TD 11,835.

Cameron Parish, West Cameron Block 192 field. Continental Oil Co.'s State Lease 1659 A-2, Block 192, Gulf of Mexico, flowed 62 barrels distillate and 4.2 million from 8490-8543 feet, 16/64-inch, completed 8-31-54, TD 9300.

West Cameron field, Block 149. Superior Oil Co.'s Bureau of Land Management A-6, Block 149, Gulf of Mexico, ungauged from Upper Miocene, 5524-36 feet, completed 8-2-54, TD 9850.

Lafourche Parish, Bully Camp field. Texas Crude Oil Co.'s Unit 1—1, in 5-18s-21e, flowed 9 barrels distillate and 2.1 million from 10,292-98 feet, 10/64-inch, 53.9-gravity, completed 7-30-54, TD 11,282.

SOUTH LOUISIANA—NEW GAS FIELD

Cameron Parish, West Cameron area. Phillips Petroleum Co.'s State Lease 1436 A-2, Block 40, Gulf of Mexico, ungauged from 10,084-93 feet, completed 8-30-54, TD 14,072.

SOUTH LOUISIANA—GAS FIELD EXTENSION

Jefferson Davis Parish, Lake Arthur field. Union Sulphur & Oil Corp.'s Elve Roach 1, in 35-10s-4w, west extension, ungauged from 12,309-39 feet, completed 8-16-54, TD 13,041.

MICHIGAN—NEW OIL FIELD

Barry County. Davidson & Winchester's Pierce 1, NW NW SE 12-1n-9w, pumped 10 barrels from Traverse lime, Devonian 1865-72 feet, TD 1872.

MISSISSIPPI—NEW DISTILLATE FIELD

Madison County, Loring field. Carter Oil Co.'s S. L. Brown (C-111-A) 1, SE NW 31-11n-4e, Old Well Worked Over, flowed 240 barrels distillate and 5.0 million from Smackover sand, Jurassic 12,130-494 feet, 31/64-inch, 49.4-gravity, completed 7-19-54, TD 12,487.

MONTANA—OIL FIELD EXTENSION

Rosebud County, Sumatra, Northwest field. Continental's Kincheloe 2-A, C SW SE 8-11n-32e, northwest extension, pumped 218 barrels from Heath sand, Mississippian 4671-4860 feet, completed 8-28-54, TD 4860.

NEBRASKA—NEW OIL FIELDS

Banner County. Carmack Drilling Co.'s Stauffer 1, SW SW SE 34-19n-55w, pumped 26 barrels oil and 55 barrels water from "I" sand, Upper Cretaceous 5828-34 and 5845-51 feet, completed 6-5-54, TD 5858.

Kimball County. Ohio Oil Co.'s Kenton 1, NE NE SE 9-14n-54w, pumped 200 barrels oil and 6 barrels water from "J" sand, Upper Cretaceous 5985-6000 feet, completed 8-3-54, TD 6070.

NEW MEXICO—NEW OIL FIELD

Lea County. Wilshire Oil Co. of Texas' Federal 12-30, in 30-20s-39e, flowed 291 barrels from Wichita-Albany lime, Permian 7248-7350 feet, ¾-inch, 37.5-gravity, completed 8-11-54, TD 9681.

NEW MEXICO—OIL FIELD EXTENSION

Lea County, Unnamed field. Great Western Drilling Co.'s State "T" 1, in 17-12s-32e, ⅝-mile west extension, flowed 72 barrels from Queen sand, Permian 2996-3040 feet, ½-inch, 38-gravity, completed 8-18-54, TD 3040.

NEW MEXICO—NEW OIL PAY

San Juan County, Blanco field. L. G. Stearns' Navajo 7, NW SE SE 36-22n-14w, pumped 14 barrels oil and 28 barrels water from Allison sand, Upper Cretaceous 809-16 feet, completed 8-18-54, TD 907.

NEW MEXICO—NEW GAS FIELD

Rio Arriba County. Phillips' Mesa Unit 2-28 31-6, NE SW SW 28-31n-6w, flowed 0.7 million from Mesaverde sand, Upper Cretaceous 5378-5950 feet, completed 8-2-54, TD 5950.

San Juan County. Benson-Montin, Inc.'s Texas-Navajo 1, SE NW NE 5-25n-8w, flowed 2.0 million from Pictured Cliffs sand, Upper Cretaceous 2016-91 feet, completed 8-16-54, TD 2091.

Unnamed field. Benson-Montin, Inc.'s Wilson 1, SE NW NW 32-26n-8w, flowed 2.0 million from Pictured Cliffs sand, Upper Cretaceous 2046-2128 feet, completed 8-16-54, TD 2128.

OKLAHOMA—NEW OIL FIELDS

Garvin County. F. L. Chapman's Hanks 1, NW SW NW 25-3n-3e, pumped 1 barrel oil and 8 barrels water from 1452-80 feet, 33-gravity, TD 1520.

Unnamed field. McPherson, Whitehurst & Bell's Hottel 1, SW SW SW 10-3n-3e, flowed 26 barrels from Bromide sand, Ordovician 1907-12 feet, 4/64-inch, 30-gravity, TD 1912.

Grady County. Kidd Williams & Pure Oil Co.'s Godwin 1, SE SW SE 10-4n-8w, flowed 160 barrels from Boatright sand, Pennsylvanian 12,506-55 feet, ¼-inch, 42-gravity, TD 12,601.

Grant County, Rich Valley, Northwest. Carter Oil Co.'s Hodges Heirs 1, NE NW NW 23-26n-5w, flowed 212 barrels from Marshall sand, Ordovician 5796-5800 feet, and 216 barrels from Simpson dolomite, Ordovician 5758-62 feet, 9/64-inch, 47.2-gravity, TD 5862.

Hughes County. David W. Taylor & Leslie Walker's Grace Doyle 1, NW NW SE 15-9n-10e, flowed 240 barrels from Gilcrease sand, Pennsylvanian 2830-39 feet, ⅛-inch, 36-gravity, TD 2858.

Kay County, Uncas, Southeast field. O. H. Parker's Alexander 1, NW NW SE 32-27n-4e, flowed 100 barrels from Skinner sand, Pennsylvanian 3201-11 feet, ½-inch, TD 3263.

Lincoln County, Northwest Chandler area. Nuckolls-Bell Drilling Co.'s Elizabeth Bevins 1, NW NW NE 30-15n-4e, flowed 25 barrels oil and 196 barrels water from Red Fork sand, Pennsylvanian 4239-52 feet, 1-inch, 35-gravity, TD 4270.

Logan County, Garden, Northeast field. Zephyr Drilling Co.'s H. S. Smith 1, NW NW NW 23-15n-1e, flowed 165 barrels from Lower Skinner sand, Pennsylvanian 4899-4905 feet, 9/64-inch, 42-gravity, TD 4905.

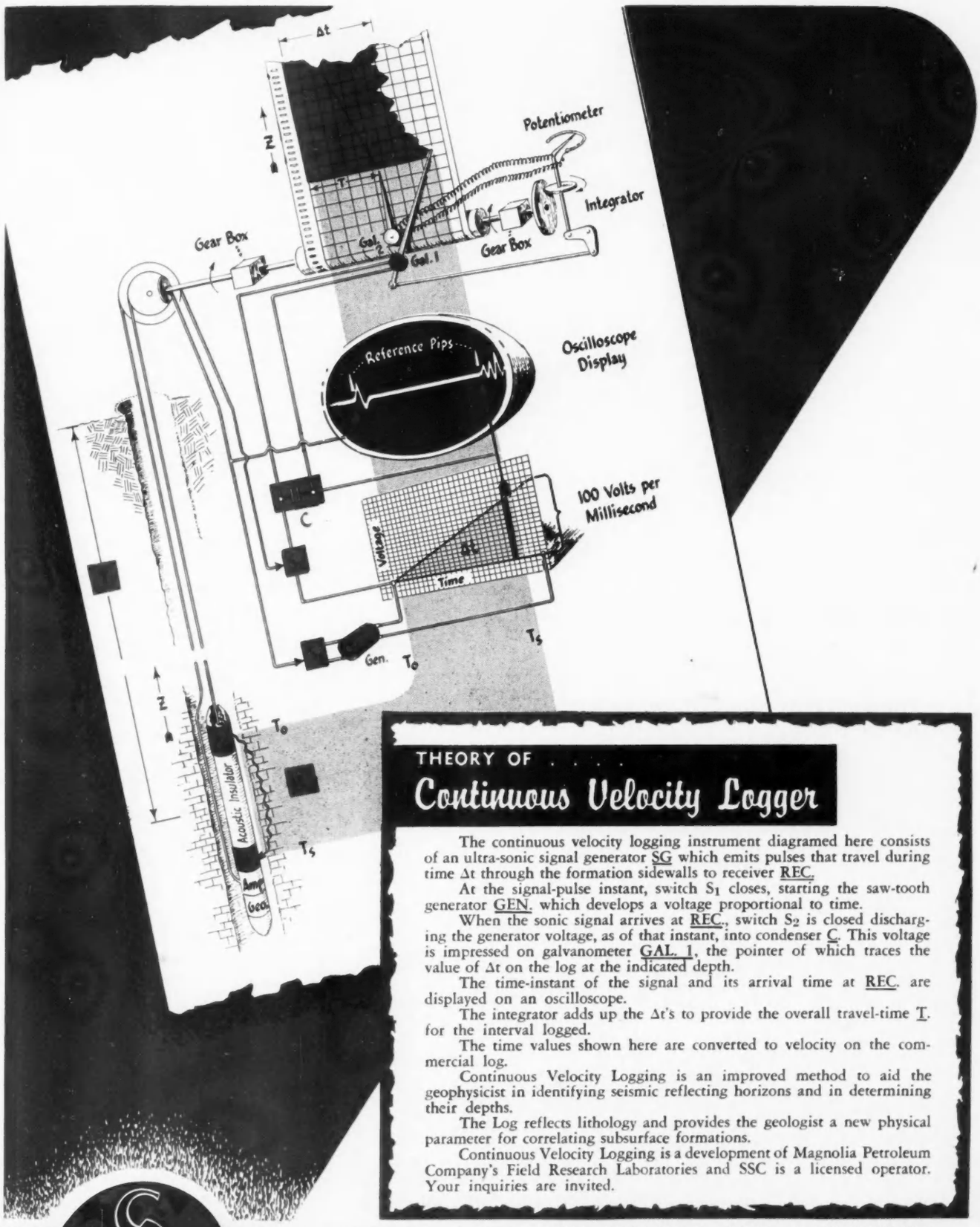
Love County, Greenville, Northeast field. A. D. Britton's Vestal 1, NW NW NW 28-6s-2e, flowed 184 barrels from Dornick Hills sand, Pennsylvanian 4034-64 and 4065-76 feet, 22/64-inch 38-gravity, TD 4076.

McCurtain County. Collvin, Young & Cavander's Epperson 1, S½ NE SE NE 5-8s-23e, pumped 8 barrels from 325-8 feet, 24-gravity, TD 328.

OKLAHOMA—NEW OIL PAYS

Beaver County, Light field. J. M. Huber's Zeilke 1, NW NE 28-6n-21ecm, pumped 30 barrels from Morrow sand, Pennsylvanian 6142-52 feet, 38.3-gravity, TD 6475.

Grady County, Chickasha field. Woodward & Company's Hawpe 1, NW NW NW 6-3n-7w, flowed 348 barrels from Noble-Olson sand, Permian 3494-3506 feet, ¾-inch, 26-gravity, TD 5623.



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Continuous Velocity Logger

The continuous velocity logging instrument diagramed here consists of an ultra-sonic signal generator SG which emits pulses that travel during time Δt through the formation sidewalls to receiver REC.

At the signal-pulse instant, switch S_1 closes, starting the saw-tooth generator GEN. which develops a voltage proportional to time.

When the sonic signal arrives at REC., switch S_2 is closed discharging the generator voltage, as of that instant, into condenser C. This voltage is impressed on galvanometer GAL. 1, the pointer of which traces the value of Δt on the log at the indicated depth.

The time-instant of the signal and its arrival time at REC. are displayed on an oscilloscope.

The integrator adds up the Δt's to provide the overall travel-time T. for the interval logged.

The time values shown here are converted to velocity on the commercial log.

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TULSA, OKLAHOMA, U.S.A.

Stephens County, Velma, West field. C. L. Carlock's Sledge 1, SW SW NW 18-1s-5w, flowed 172 barrels from Deese sand, Pennsylvanian 5210-22 feet, 16/64-inch, 35-gravity, TD 6525.

OKLAHOMA—OIL FIELD EXTENSION

Lincoln County, Sunflower, Southeast field. Kingwood Oil Co.'s Oscar Green 1, NW NW NE 33-14n-2e, south extension, flowed 95 barrels from Checkerboard sand, Pennsylvanian 3803-14 feet, 8/64-inch, TD 3840.

TEXAS DISTRICT 1—NEW OIL FIELD

Atascosa County. Harrel & Southworth's Milton Davis 1, W. W. Robbin Survey 116, flowed 62 barrels from Navarro sand, Upper Cretaceous 4632-42 feet, 10/64-inch, 43.1-gravity, TD 4676.

TEXAS DISTRICT 1—OIL FIELD EXTENSION

Atascosa County, Imogene, South field. Frio Production Corp.'s Sam C. Richter 1, Dr. Charles F. Simmons Subdivision, Section 25, Lot 556, ½ mile northeast extension, pumped 8 barrels from Reklaw sand, Eocene 1775-86 feet, 22.1-gravity, completed 5-23-54, TD 1815.

TEXAS DISTRICT 2—NEW DISTILLATE FIELD

Karnes County, "Oatkin" field. Delange & O. Neathery Jr.'s J. W. Oatkin 1, Auld & Carter Subdivision, flowed 115 barrels distillate and 7.5 million from Wilcox sand, Eocene 6518-28 feet, open, 53.3-gravity, completed 7-20-54, TD 6700.

TEXAS DISTRICT 3— NEW OIL PAYS

Harris County, Humble-Light field. I. Rauch, Trustee's H. C. House 23, Mary Owens Survey, flowed 178 barrels from 4252-58 feet, 14/64-inch, 35.8-gravity, completed 8-9-54, TD 4304.

Humble-Light field. I. Rauch, Trustee's H. C. House 24, Mary Owens Survey, flowed 165 barrels from "A" sand, Oligocene 4108-32 feet, 14/64-inch, 33-gravity, and 126 barrels from "B" sand, Oligocene 4154-64 feet, 12/64-inch, 34.5-gravity, completed 8-17-54, TD 4554.

Liberty County, Hankamer (North Flank) field. Dan J. Harrison, Jr.'s "A" Fee 9, H&TC RR Survey, flowed 141 barrels from 3816-28 feet, 9/64-inch, 26.8-gravity, completed 8-13-54, TD 4103.

Montgomery County, Conroe Townsite field. Humble's Conroe Townsite Gas Unit 1—1, John Bricker Survey, flowed 45 barrels distillate and 8.9 million from Cockfield "T" sand, Eocene 4899-4915 feet, open, 48.6-gravity, and 113 barrels oil from Cockfield "C" sand, Eocene 4934-42 feet, ⅛-inch, 38.3-gravity, completed 7-22-54, TD 6500.

Newton County, Sabine Tram, West field. Christie, Mitchell & Mitchell's E. C. Hankamer et al 2, J. C. Patton Survey No. 1, flowed 100 barrels oil and 4 barrels water from Yegua sand, Eocene 8197-8207 feet, 10/64-inch, 38-gravity, completed 8-3-54, TD 8712.

Polk County, Goodrich field. H. B. & B. Drilling Corporation's Charley M. Broman 1, A. Viesca Survey, flowed 41 barrels from 3472-77 feet, 10/64-inch, 29.6-gravity, completed 2-1-54, TD 4392.

Tyler County, Pavey field. Humble's East Texas Oil Co. Fee "H" 1, G. W. Roper Survey, flowed 39 barrels oil and 19 barrels water from 8746-74 feet, 9/64-inch, 37.5-gravity, completed 7-29-54, TD 10,500.

Wharton County, Louise field. Caribbean Oil Corp.'s Guy F. Stovall 1, Morris & Cummings Survey, flowed 93 barrels from Frio sand, Oligocene 5454-56 feet, 8/64-inch, 27.8-gravity, completed 8-24-54, TD 5540.

TEXAS DISTRICT 3—NEW DISTILLATE FIELD

Chambers County, "Walla-Boyt" field. Wesley West's E. W. Boyt et ux 1, T&NO RR Survey, flowed 2,400 barrels distillate and 20.0 million from Nodosaria (Basal Frio) sand, Oligocene 8763-69 feet, 55.3-gravity, completed 8-15-54, TD 8780.

TEXAS DISTRICT 3—NEW DISTILLATE PAY

Colorado County, Garwood (NW Flank) field. Christie, Mitchell & Mitchell's C. A. Bass 2, George J. Duncan Survey, flowed 148 barrels distillate and 7.3 million from Wilcox sand, Eocene 8625-45, 8678-8700 and 8702-12 feet, 52-gravity, completed 6-23-54, TD 10,300.

TEXAS DISTRICT 3—NEW GAS FIELDS

Jefferson County. Stanolind O&G Co.'s Gladys City Oil & Gas & Mfg. Co. 6-B, John A. Veatch Survey, flowed 12.5 million from 5553-93 feet, open, completed 8-22-54, TD 6060.

Liberty County, Davis Hill area. The Texas Co.'s Wirt Davis Estate "C" O/A 1, Manvel De Los Santos Coy Survey, ungauged from 3548-70 feet, completed 6-21-54, TD 3922.

TEXAS DISTRICT 4—NEW OIL FIELDS

Kleberg County, "Alazan" field. Humble's King Ranch-Alazan 2, "El Alazan" Grant, Alazan Pasture, flowed 27 barrels oil and 13 barrels water from 5748-56 feet, ⅛-inch, 47.3-gravity, completed 8-21-54, TD 11,958.

San Patricio County. Arnold H. Bruner's John Hancock Mutual Life Ins. Co. 1, T. T. Williamson survey, flowed 68 barrels oil and 56 barrels water from Sinton sand, Oligocene 5579-81 feet, ¼-inch, 32-gravity, completed 8-17-54, TD 7018.

TEXAS DISTRICT 4—NEW OIL PAYS

Brooks County, Mills Bennett field. Mills Bennett Est.'s Mills Bennett Fee 10, Juan Jose Guerra, El Tule Grant, flowed 85 barrels from "A" sand, Eocene 3820-28 feet, ⅛-inch, 40.3-gravity, completed 8-29-54, TD 6015.

Scott & Hopper, Hawn Bros.' Mestena Oil & Gas Co. 3, La Mestena Y Gonzales Grant Charco Martinez Block 11, flowed 89 barrels from Vicksburg sand, Oligocene 6931-38 feet, 7/64-inch, 42-gravity, completed 7-28-54, TD 7515.

Jim Wells County, Seeligson field. Sunray Oil Corp.'s A. A. Seeligson B-45, McKinney & Williams 276, R. P. Haldemans Subd., Section 64, flowed 140 barrels from Vicksburg (Zone 20-C-4) (2) sand, Oligocene 7004-12 feet, 20/64-inch, 41-gravity, completed 8-12-54, TD 7055.

Nueces County, Calallen, West field. Phillips Petroleum Co.'s Calallen 1, Wade Riverside Subdivision, Section 5, flowed 170 barrels from 7510-20 feet, ⅛-inch, 36.1-gravity, completed 8-22-54, TD 9008.

San Patricio County, North Pasture field. Taylor O&G Co.'s Big "L-I" Pasture 2, M. J. de la Garza Survey, flowed 91 barrels from Frio sand, Oligocene 7291-93 feet, 7/64-inch, 42.8-gravity, completed 8-21-54, TD 7798.

Willacy County, La Sara field. The Superior Oil Co.'s Yturria Cattle Co. 2, San Juan de Carricitos Grant, flowed 70 barrels oil and 3 barrels water from Heterostegina Zone 38 sand, Oligocene 6411-21 feet, 8/64-inch, 40.5-gravity, completed 8-8-54, TD 7700.

TEXAS DISTRICT 4—NEW DISTILLATE FIELDS

Nueces County, "McCullough" field. Burdett Graham's V. D. McCullough 1, Richard King Farm Lots, N½ Section 39, Old Well Worked Over, flowed 124 barrels distillate and 12.2 million from Frio 5481-85, 62.9-gravity, completed 8-13-54, TD 5579.

Kenedy County, "Laguna Madre" field. Continental Oil Co.'s State of Texas Tr 393-1, Laguna Madre Tract 393, flowed 200 barrels distillate and 20.0 million from Frio sand, Oligocene 9404-34 feet, open, 65-gravity, completed 8-5-54, TD 13,000.

TEXAS DISTRICT 4—NEW GAS FIELD

Starr County, "Hinde" field. Blair—Vreeland's L. M. Bentsen et al 1, Los Magueyes, Block 6, Lot 13, flowed 70 barrels distillate and 10.5 million from Frio sand, Oligocene, 4906-14 feet, 65.7-gravity, completed 8-9-54, TD 6294.

TEXAS DISTRICT 4— NEW GAS PAY

Nueces County, London Gin, Southwest field. C. C. Winn's George Taylor-D. L. Connolly 1, Ramon de Ynojosa Grant, Laureles Farm Tracts, Section 24, flowed 13.5 million from Catahoula sand, Oligocene 4546-52 feet, open, completed 8-21-54, TD 4583.

TEXAS DISTRICT 5—NEW OIL FIELDS

Hopkins County, Birthright field. F. R. Jackson's Spencer 1, G. Linceum Survey, pumped 125 barrels from Paluxy sand, Lower Cretaceous 4740-43 feet, 53-gravity, completed 8-3-54, TD 4857.

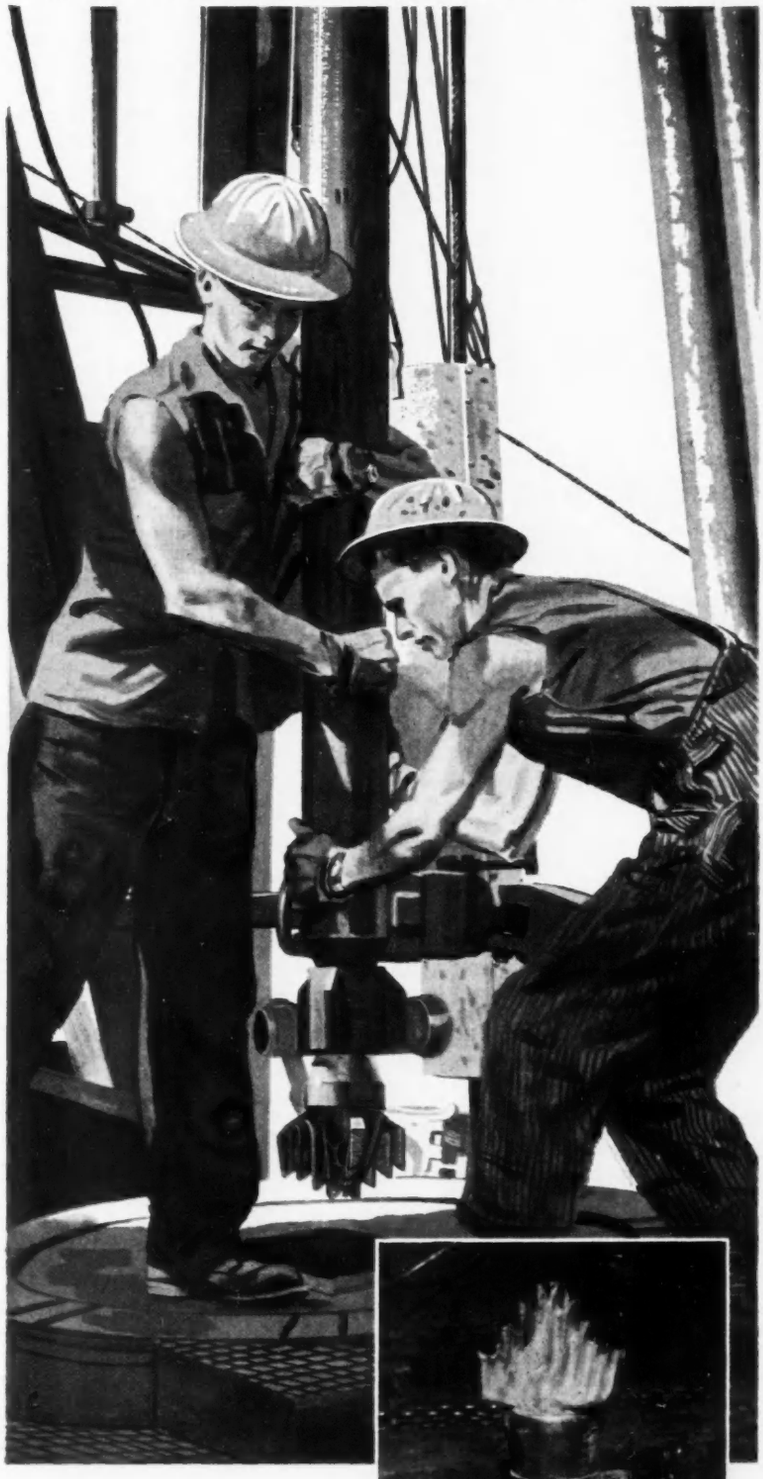
Limestone County. W. A. Reiter et al's T. Norris 2, H&TCC RR Survey, pumped 24 barrels from Wolfe City sand, Upper Cretaceous 2027-36 feet, 38-gravity, completed 8-23-54, TD 2040.

TEXAS DISTRICT 6—NEW OIL PAYS

Cass County, Kildare field. F. R. Jackson et al's Texas Co.-Berry Davis 1, Briggs W. Hopson Survey, flowed 181 barrels

ECONOMICS OF MORE EFFICIENT SLIM HOLE DRILLING—NO. 1

CUT COST PER FOOT BY INCLUDING "BLUE DEMONS" IN YOUR SLIM HOLE PROGRAM



The major slim hole drilling advantage is economic. Reduced drilling costs per foot can result from efficient use of smaller equipment and crews . . . a lower investment, with savings in labor, rig-up, travel, fuel and maintenance.

You can be sure of spreading your slim hole drilling dollars over more prospects by using Hawthorne "Blue Demon" Rock Cutters, the bits designed with smaller holes in mind. "Blue Demons" consistently provide faster penetration, in comparative slim hole drilling tests, efficiently out-performing even roller bits under the proportionately greater weights and stresses attained in smaller holes . . . drilling up to 2500 feet per bit with weights to 25,000 pounds.

The 7⅞" Type SH "Blue Demon" pictured here had just completed 1800 feet in 9 hours drilling, including make-up time . . . averaging 200 feet per hour . . . 10 minutes per joint . . . at rates up to 325 feet per hour under six drill collars. Slope tests showed 0 degrees, with stabilizers in the string.

THE COST PER FOOT EQUATION WOULD LOOK LIKE THIS:

$$\text{Cost per foot} = \frac{\$47.00 + (\$20.00 \times 9)}{1800 \text{ (bit footage)}} = \frac{\text{bit cost} + (\text{rig cost/hr} \times \text{total hours})}{1800 \text{ (bit footage)}} = \$0.126$$

When planning your ultra-slim hole, slim hole exploratory, slim hole structure, stratigraphic, slim hole production and core hole drilling programs, be sure to specify "Blue Demons" . . . recognized leader for economical performance in the small bit field. Available in 3", 4¾", 5⅝", 6¼", 6¾", 7⅜" and 7⅞" slim hole sizes, for fluid or air drilling.

WRITE FOR ILLUSTRATED CATALOG

HERB J. HAWTHORNE INC.

P. O. BOX 7366, HOUSTON 8, TEXAS

U.S. PATENTS 2,615,684 2,666,622 OTHERS PENDING

5201

from Pettit lime, Lower Cretaceous 6668-74 feet, 12/64-inch, 43-gravity, completed 8-13-54, TD 6678.

Harrison County, Locust Grove field. Midstates Oil Corp.'s T. J. Taylor 1, Wilson Ewing Survey, flowed 173 barrels from Pettit lime, Lower Cretaceous 6222-27 feet, 14/64-inch, 35-gravity, completed 8-18-54, TD 6600.

TEXAS DISTRICT 6—NEW DISTILLATE PAY

Houston County, Grapeland field. Geier-Jackson, Inc.'s Herod-Musick Unit 4-A, J. De J. Procella Survey, flowed 40 barrels distillate and 5.4 million from Sub-Clarksville sand, Upper Cretaceous 5837-38 and 5842-44 feet, open, 59.9-gravity, completed 8-23-54, TD 6005.

TEXAS DISTRICT 7-C—NEW OIL FIELDS

Coke County. C. L. McMahon, Inc. et al's A. S. Hendry 1, J. Holleman Survey 305, flowed 142 barrels from Gardner lime, Pennsylvanian 5346-53 feet, 13/64-inch, 43.9-gravity, completed 8-23-54, TD 5823.

Unnamed field. C. T. Robertson et al's Nora Gee 1, Section 119, Block 2, H&TC Survey, Old Well Worked Over, flowed 184 barrels from Strawn sand, Pennsylvanian 7004-76 feet, 16/64-inch, 47-gravity, completed 8-3-54, TD 8120.

Crockett County. Humble & Continental's University "AB" 1, Section 12, Block 51, University Lands Survey, flowed 114 barrels oil and 3 barrels water from Fussleman lime, Silurian 9240-96 feet, 14/64-inch, 44.6-gravity, completed 7-19-54, TD 9549.

Runnels County. Miama Operating Co. Inc.'s H. F. Lindemann 2—A, Austin & Williams Survey 262, flowed 397 barrels from Jennings sand, Pennsylvanian 3666-69 feet, 18/64-inch, 40-gravity, completed 7-23-54, TD 3898.

Unnamed field. T. D. Humphrey & Sons, Ltd.'s J. E. Gentry 1, J. C. Taylor Survey 804, pumped 154 barrels oil and 6 barrels water from Cross Cut sand, Pennsylvania 4282-87 feet, 38.9-gravity, completed 7-28-54, TD 5288.

Sutton County. Stanolind's Joe B. Ross 1, Section 26, Block 14, TW&NG Survey, flowed 7 barrels from Canyon sand, Pennsylvanian 4450-70 feet, ½-inch, 29-gravity, completed 8-19-54, TD 4950.

TEXAS DISTRICT 7-C—NEW OIL PAY

Runnels County, Elm Creek, South field. Walter Duncan's J. C. Bloxum 1, John Brown Survey 528, pumped 52 barrels from Serratt sand, Pennsylvanian 2448-52 feet, 2⅜-inch, 42-gravity, completed 8-20-54, TD 2452.

TEXAS DISTRICT 7-C—OIL FIELD EXTENSION

Crockett County, "Pure-Bean" field. Sinclair O&G Co.'s Nettie Holt 3, Section 63, Block OP, GC&SF Survey, ¾-mile northeast extension, pumped 72 barrels oil and 11 barrels water from Ellenburger lime, Ordovician 7606-40 feet, 38-gravity, completed 8-2-54, TD 7723.

TEXAS DISTRICT 7-C—NEW DISTILLATE FIELD

Sutton County. Ray Morris Drilling Co.'s H. A. Thompson Estate 1, Section 32, Block A, HE&WT Survey, flowed 196 barrels distillate and 25.0 million from Canyon sand, Pennsylvanian 5218-60 feet, 65-gravity, completed 7-28-54, TD 5605.

TEXAS DISTRICT 7-C—NEW GAS FIELDS

Sutton County. C. L. Norsworthy Jr.'s Ben F. Meckel 2, Section 93, Block A, HE&WT Survey, flowed 0.3 million from Canyon sand, Pennsylvanian 5462-5520 and 5566-5618 feet, 2-inch, completed 7-3-54, TD 5830.

Unnamed field. Stanolind's W. A. Miers 1-A, Section 15, EL&RR Survey, flowed 8.2 million from Canyon sand, Pennsylvanian 5573-5733 feet, 2½-inch, completed 8-11-54, TD 5733.

TEXAS DISTRICT 8—NEW OIL FIELDS

Andrews County. Atlantic Refining Co.'s University "9-C" 1, Section 14, Block 9, University Lands Survey, flowed 327 barrels from Pennsylvanian sand, 8924-50 feet, ½-inch, 42-gravity, and 610 barrels from Devonian lime, 10,350-450 feet, ¼-inch, 45-gravity, completed 7-17-54, TD 12,735.

Unnamed field. Ralph Lowe's W. H. Sloan 1, Section 4, Block A-43, PSL Survey, flowed 3006 barrels from Ellenburger lime, Ordovician 12,260-320 feet, ¾-inch, 43.8-gravity, completed 7-25-54, TD 12,373.

Unnamed field. Vests, Dorbaudt & Ross' H. C. McQuatters Trustee 1-D, Section 20, Block A-34, PSL Survey, flowed 361 barrels from Queen sand, Permian 4154-64 and 4175-91 feet, 16/64-inch, 31-gravity, completed 8-13-54, TD 4226.

Unnamed field. Seaboard Oil Co. et al's L. B. Vaughn 1, Section 39, Block 34, T-5-N, T&P Survey, flowed 384 barrels from Reef lime, Pennsylvanian 8195-227 feet, ¼-inch, 39-gravity, completed 8-9-54, TD 8285.

Garza County. Cecil Oil Corp.'s Luther Reed et al 1, Section 117, Block 5, H&GN Survey, pumped 171 barrels oil and 34 barrels water from San Andres lime, Permian 2515-25 feet, 40-gravity, completed 8-6-54, TD 2530.

Unnamed field. Edwin L. Cox's J. D. Chaffin 1, Section 1255, TTRR Survey, pumped 112 barrels oil and 53 barrels water from San Andres lime, Permian 3704-08 feet, 37.1-gravity, completed 8-5-54, TD 3830.

Lamb County. The Texas Co.'s Texas-Seaboard & C. R. Kirk 1, Section 6, Block 1, R. M. Thompson Survey, pumped 176 barrels oil and 86 barrels water from Clearfork lime, Permian 6414-66 and 6482-91 feet, 22-gravity, completed 8-11-54, TD 6494.

Martin County, Ackerly field. Stanolind's C. M. Brown 1, Section 15, Block 34, T-3-N, T&P Survey, Old Well Worked over, pumped 65 barrels oil and 1 barrel water from Dean sand, Pennsylvanian 8280-8316, 8325-45 and 8370-96 feet, 38-gravity, completed 8-11-54, TD 9562.

Reeves County. Ken Regan et al's C. E. Bolinger 1, Section 16, Block 56, T-3, T&P Survey, flowed 130 barrels from Delaware sand, Permian 3350-60 feet, ½-inch, 35.9-gravity, completed 8-5-54, TD 3360.

TEXAS DISTRICT 8—NEW OIL PAYS

Andrews County, Means field. Humble's J. S. Means 134, Section 3, Block A-35, PSL Survey, Old Well Worked Over, flowed 380 barrels from Queen sand, Permian 4024-36 and 4044-64 feet, ½-inch, 32.4-gravity, completed 8-5-54, TD 4545.

University-Block 9 field. Atlantic's University "9-E" 1, Section 14, Block 9, University Lands Survey, flowed 257 barrels oil and 5 barrels water from Devonian lime 10,394-449 feet, ¼-inch, 44-gravity, completed 7-30-54, TD 10,800.

Ector County, Goldsmith field. Cities Service Oil Co. et al's TXL 1-M, Section 37, Block 45, T-1-N, T&P Survey, pumped 94 barrels oil and 12 barrels water from Lower Clearfork lime, Permian 6266-76, 6284-6300, and 6303-12 feet, 36.5-gravity, completed 8-3-54, TD 8215.

Yoakum County, Bronco field. Skelly Oil Co.'s Kendrick 1-A, Section 455, Block D, J. H. Gibson Survey, pumped 77 barrels oil and 14 barrels water from San Andres lime, Permian 5182-280 feet, 31-gravity, completed 8-4-54, TD 11,860.

TEXAS DISTRICT 8—OIL FIELD EXTENSIONS

Howard County, Luther, Southeast field. Texas Pacific Coal & Oil Co.'s M. C. Hyden 1, Section 47, Block 32, T-3-N, T&P Survey, 1½-mile north extension, flowed 196 barrels from Siluro-Devonian lime 9905-15 feet, 24/64-inch, 43.3-gravity, completed 8-11-54, TD 10,055.

Moore field. Callihan Rotary Co.'s Creighton 1, Section 29, Block 33, T&P Survey, 2-mile extension, pumped 164 barrels from San Andres lime, Permian 3028-71 feet, 38-gravity, completed 8-20-54, TD 3071.

Kent County, Cogdell field. Chapman & McFarlin Production Co.'s D. M. Cogdell 85, Section 47, Block 4, H&GN Survey, ⅞-mile northeast extension, pumped 6 barrels from San Andres lime, Permian 1515-30 feet, 38.5-gravity, completed 8-27-54, TD 7211.

TEXAS DISTRICT 10—NEW GAS FIELD

Hansford County. Colorado O&G Co.'s & R. H. Fulton's J. J. Steele 1, Section 49, Block 45, H&TC Survey, flowed 4.8 million from Atoka sand, Pennsylvanian 5256-68 feet, completed 7-27-54, TD 7590.

WYOMING—NEW OIL FIELD

Niobrara County. Justheim Oil Co.'s Government 1, SW NE SE 33-41n-61w, flowed 200 barrels from Newcastle lime, Upper Cretaceous 7656-76 feet, open, completed 7-28-54, TD 7740.

WYOMING—NEW GAS FIELDS

Sublette County. Arthur Belfer's Unit 2-C, SE NW SE 14-28n-113w, flowed 1.7 million from Almy sand, Eocene 2028-3161 feet, completed 5-7-54, TD 3161.

Sweetwater County, Canyon Creek area. Mountain Fuel Supply Co.'s Unit 3, C NE SW 3-12n-101w, ungauged from Mesaverde sand, Upper Cretaceous 5460-5544 feet, completed 8-16-54, TD 6549.

"High drilling costs make it necessary for contractors to adopt any and all methods that will reduce the expense of drilling wells."

A. W. Thompson, Chairman of Research and Education Committee of AAODC
(See Page 81 of this issue)

Here Are 35 Money-Saving Ideas That Helped Other Contractors

By PHILIP L. McLAUGHLIN, Drilling Editor, WORLD OIL

EACH OF THE ideas presented here has saved some drilling contractor some money. These ideas have been proven practical. They have found acceptance in widely scattered oil fields.

A primary consideration in drilling a well is to have equipment capable of meeting drilling conditions. This equipment must be set properly on location if it is to perform satisfactorily the functions for which it was designed.

Often a more thorough planning of these two operations will result in considerable saving of time and money.

This collection of ideas is offered as a service to the contractor. Review each phase of your operation. Will your rig reduce to a fewer number of loads? What can be done to speed moves? How can you save time on location? Look at your own cost sheets. Perhaps these ideas will help you.

SAVE MONEY PREPARING FOR MOVE

1. Hold informal crew meetings . . .

One drilling contractor indicated that there are numerous angles to consider in tearing down and rigging up that can be turned into substantial savings. Many short cuts can be taken in each phase of the drilling operation if the contractor takes time to analyze each step.

This company has inaugurated an informal meeting of the crew members a few days before the completion of a well. This meeting is similar to a military tactical planning meeting in which each man's responsibility is outlined for the forthcoming tear-down, move and rig-up operation. While the rig is still on day rate, each crew member is told about the next location (if there is one readily available).

The equipment that is not needed in the final phases of completing and testing can be moved and is made ready. Importance of speeding up the tear-down and rigging-up operations cannot be over-emphasized because the rig is losing money each day the bit is not "turning to the right."

2. Start moving extra equipment . . .

During "day work" operations, the contractor's trucks can start moving all equipment not required in the completion of the present well. The equipment—including toolhouses, extra water tanks, and pumps—can be set off to the side of the present location or moved to the next location.

Provisions should have been made to have the next rig location completed by the time the first load is ready to arrive. Planning the move includes preparing the new location so time will not be lost.

3. Survey the area . . .

While the rig is still on day rate at the old location, some drilling contractors send the drilling superintendent or assistant drilling superintendent to look over the new location shortly after the producing company has completed clearing operations.

It is the superintendent's duty to investigate road conditions, availability of water, level of the location, and the accessibility for ease of rig-up. The closeness to sources of equipment supply, food, and lodging facilities for the crew is important.

4. Find water . . .

In various sections of the country water presents no problem. But in West Texas a water well must be drilled; on the Gulf Coast it means a water well or a pipe line from a river or pond; in remote wildcat sections it means water must be hauled to the location.

The most inexpensive method must be decided upon immediately by the drilling superintendent. It is important that the extra water tanks be transferred to the new location and filled as soon as possible. This should be done before or during the actual rigging-up operation.

Continued on Page 134

MONEY-SAVING IDEAS

5. Make a map . . .

Some drilling contractors feel that it is important to provide toolpushers, truck drivers and crewmen with written instructions indicating the best route to the new location. Roads, bridges, underpasses, and culverts should be plainly dimensioned and inspected.

The planning of the rig-up operation should set forth which pieces of equipment are to be moved first and the order in which they should be transported to the next location.

6. Talk to the farmer . . .

Definite arrangements should be made with the property owner to obtain his permission for moving the rig onto the proposed location. Many drilling contractors have been confronted with irate landowners who have not been previously informed of the transfer of equipment onto his property. It promotes good public relations to advise the landowner, so that cordial relations will exist during the drilling of the well and possible future operations.

7. Lay aluminum fuel lines . . .

One drilling contractor, Hugh Kirkpatrick, Inc., of Mission, Texas, has found the use of aluminum pipe has been responsible for impressive cost savings in carrying fresh water to his rig in South Texas. This coupled with the ease with which the aluminum could be connected enabled him to lay 8000 feet of line in 1 hour and 45 minutes. Further savings were effected when it was found that the aluminum could be transported in a single pipe trailer load.

Other drilling contractors have used aluminum pipe and plastic pipe to carry water and natural gas to drilling rigs from remote sources. The 30-foot-long aluminum joints weigh less than 17 pounds each and can be handled easily by one man. Because of their very low coefficient of friction, inexpensive positive displacement pumps or small centrifugal pumps rated at moderate pressures can be used to transport the water considerable distances.

In some areas a rental service is available at reasonable prices. The contractor can save money because he cannot possibly transport heavy steel pipe or lay it as cheaply as the rental service provides. Valuable rig-up time and tear-down time can be saved, as well as a saving on transportation. All fuel lines should be laid before the arrival of rig equipment.

TUNGSTEN CARBIDE AUGER is being used to dig ratholes, mouseholes and surface holes. Contractors have realized big savings.

8. Contract the rathole . . .

Some contractors in the Permian Basin of West Texas and New Mexico have saved money by contracting their ratholes, mouseholes, and surface holes. In any area where limestone or caliche rock are found on the surface it would pay to investigate rathole services. Surface rock presents a problem to the rotary drilling contractor who must drill through it before setting surface pipe. At times the drilling contractor in surface rock country spends as much as 16 to 18 hours digging the rathole alone. If rat, mouse, and surface holes can be drilled before equipment is moved, it means considerable saving.

The cost of digging the rathole and mousehole and starting the surface hole generally runs to approximately $2.50 per foot in soft-digging areas and $4 per foot in hard-rock areas. In cash value, this usually costs the contractor from $140 to $800 or approximately 4 to 16 hours rig time.

Shown here is a new type tungsten carbide bit used as an all-purpose auger. This bit is capable of digging through flint-hard frozen earth, rocky or rooty soil, shale, sandstone, limestone, cement slag, fills, gumbo, or gravel. Screw-type augers or large-diameter rock bits are commonly used.

The hole usually is drilled large enough for the rathole and mousehole pipe and at the angle to conform to the rig dimensions. Some contractors have designed metal templets to accommodate rathole diggers.

9. Dig earthen pits and cellar . . .

If rig tanks are not available, the digging of earthen pits should be arranged for prior to the arrival of the first load. This should also include arrangements for the digging of the cellar, the building of all roads, and the leveling of all location sites.

MONEY-SAVING IDEAS

SAVE MONEY TEARING DOWN

The rig move represents a large portion of the overall well expense. Contractors should have a well-organized plan to reduce moving costs. To drilling people, a fast move is a cheap move. Profits increase as the moving cost and rig-up time go down. Have all equipment ready for the trucking contractor. Transport equipment first which will be needed first at the new location.

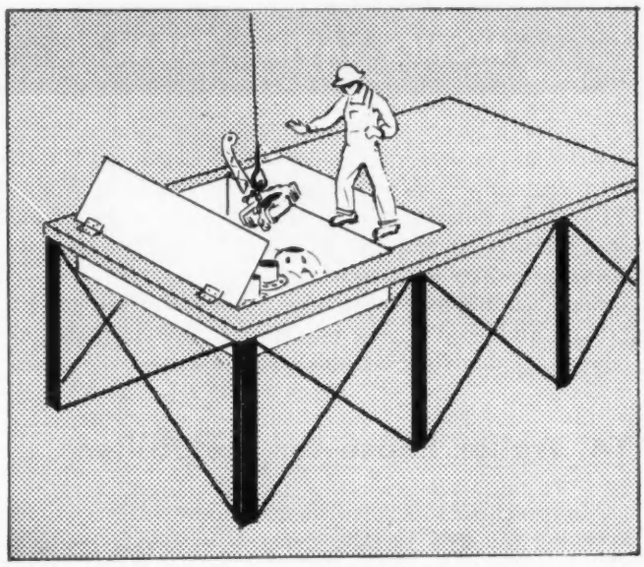
ONE LOAD ON WHEELS. Doghouse, diesel tank, butane tank, water tank and lubricating storage have been combined into one load.

10. Reduce the number of loads . . .

One drilling contractor in the interest of cutting down the number of auxiliary items needed around the rig has integrated the doghouse, diesel tank, butane tank, water tank, and lubricating storage into one load on wheels. These are commonly separate loads in themselves. Large tandem axles were installed permanently under a specially-designed trailer. A 2500-gallon diesel tank runs the full height of the structure. Sixty barrels of washdown water can be stored on top of the doghouse. The load moves rapidly and weighs approximately 40,000 pounds.

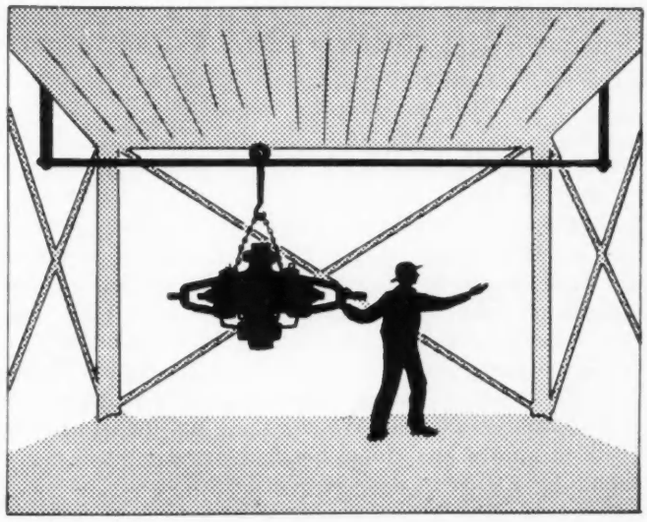
11. Fill up the mud tanks . . .

Pick up every stray piece of rig iron on the location and dump into the steel mud tanks. "Fill 'em up with pig iron and cut down on loads" is the motto of many contractors today. Many contractors have found that it drastically reduces the number of transport loads required.



12. Store equipment in floor . . .

One drilling contractor has built a trap door into the floor of the substructure where tongs, subs, elevators and odds and ends commonly kept on rig floor are lowered in a room or storage compartment below. The usual handling place for such equipment, the doghouse, remains clean since no equipment is stored here. And 150-200 pound tongs would not have to be carried to storage.



13. Monorail to move equipment . . .

There are a number of trolley designs suitable for the handling of blowout preventer equipment. Some rig manufacturers will provide variations upon request. One contractor has fabricated an overhead trolley-way out of a monorail built into the substructure. An adjustable lock keeps the chain-hoist in any desired position along the length of monorail. In this way the trolley can be used for moving preventers out of the way. During rig moves or skidding operations the preventers are chained and stored and transported in the substructure.

When needed on new location, the preventers are

rolled into place over the hole and "buckled" up. To the contractor this saves wrestling heavy equipment around, minimizes damage and need for repair of preventer and stud bolts, keeps mud out of preventer and prolongs the life of preventer equipment.

Some contractors lay a short railroad track on the ground and weld wheels on the preventer frame to facilitate the handling of bulky equipment.

14. Trailer house for toolpusher . . .

Many contractors have bought house trailers to use as living quarters for the toolpusher and guests. The trailer is the responsibility of the pusher and is pulled as a unit behind the pusher's car. This cuts the cost of one expensive load.

15. Unitize the mud tank . . .

A West Texas contractor put one end of a No. 1 mud pit below the shale shaker, incorporating all provisions for shale washdown and mud drainage. By shortening the mud pit 4 to 5 feet, he built a room into the body of the pit, with a door at the end, thus enclosing a mud testing laboratory. Special piping in the laboratory allows testing of mud by the turn of a valve. This moves as one unit.

16. Install built-in mud piping . . .

Many contractors are considering ways of reducing surface line losses by reducing the number of bends or turns in the piping from the pumps to the stand pipe. One contractor has arranged his piping for mud, fuel and water so that they are integral with the substructure.

By breaking two or three quick action unions, the rig is ready to move. The unit is compact with no loose piping or unnecessary ells. When rigging up, the equipment is lined up and the unions are hammered tight.

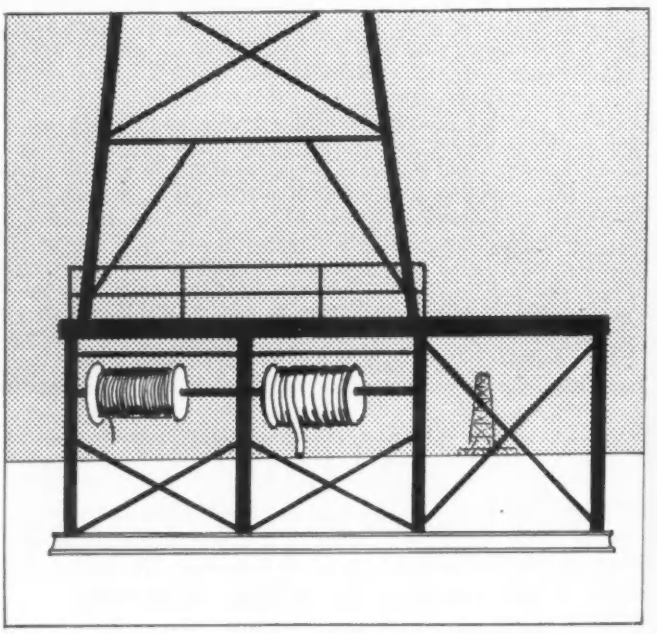
17. Set doghouse above junk box . . .

One drilling contractor has combined the doghouse and change-room into one long building on stilts above the junk box. The longitudinal axis of the doghouse is set parallel with the side of the derrick, rather than perpendicular. The building sets on stilts of 5½ inch drill pipe above the junk box shown and is suspended in place by steel pins under the doghouse. When ready to move, a winch line from a gin pole truck lifts the building so pins can be removed and lower the building on top of the junk box, which has been filled with rig iron. The stilts telescope into the doghouse roof. The loaded junk box and doghouse move as one unit.

18. Combine generator house and mud tank

One drilling contractor in California has combined the generator house, tool house, and an elevated 250 barrel mud tank to provide for more efficient utilization of space. Both units are skid mounted and hauled as either single or separate units. Portability and compactness mark the streamliness of this drilling operation. This arrangement brings these units much closer to the derrick floor where they are easily accessible and permits a more efficient utilization of space and one which requires less piping and wire ordinarily needed to hook up with facilities to mud lines and rig lighting equipment.

The adoption of such grouping, especially in connection with jack-knife rigs, is of material aid in reducing non drilling time on the job.

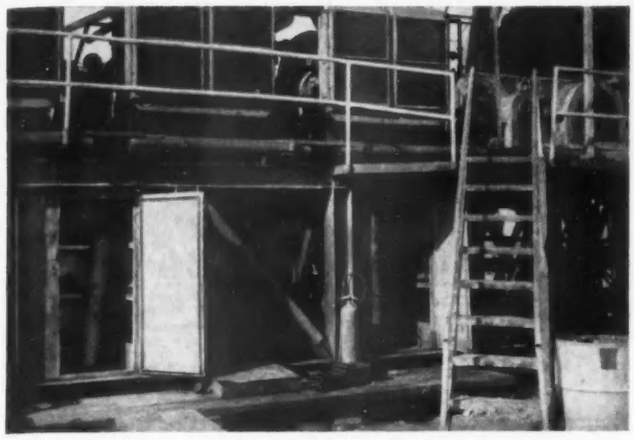


19. Adapt a reel for rig hose . . .

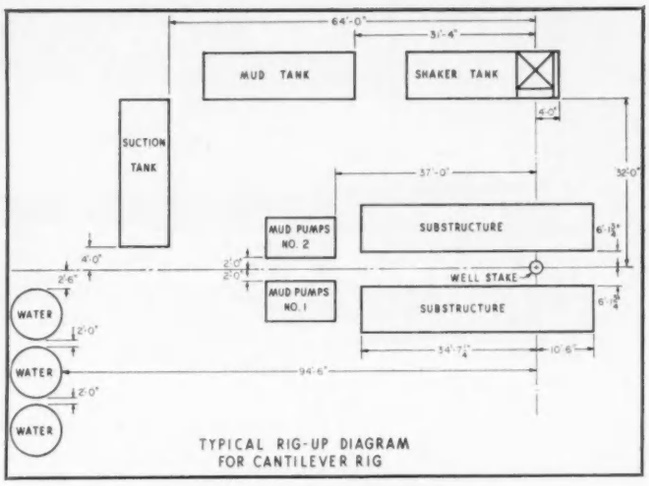
One drilling contractor has suggested that a oil resistant hose can be buried as a gas fuel line or water line. This contractor uses such a hose which is capable of being reeled on a spool when not in use or during moves, mounted in the substructure. This eliminates the laying and connecting of steel pipe and conserves valuable transport space. Some drilling contractors have reels provided for electric wiring which can be stored on spools built into the substructure.

20. Use pipe skids . . .

Kansas drilling contractors have found the use of pipe skids or "junk baskets" fabricated of 4½-inch drill pipe which are easily loaded on a truck will expedite moves. Junk baskets are positioned on each side of the walkway with wood pipe skids positioned so pipe may be rolled directly into the baskets for fast moves.



ROOMS ARE BUILT into substructure of this rig.



21. Use substructure space . . .

Anything the drilling contractor can do to minimize the number of truck loads is putting money in his pocket. Although there are many ways of conserving space or utilizing equipments which will consolidate loads, perhaps one of the most practical is that of building tool houses for hauling rig equipment into the substructure base. The accompanying picture shows a West Texas rig that has been so designed, resulting in savings to the contractor. If a storage space can be provided in the heavy substructure base so that loose rig equipment can be stored it would help to eliminate additional tool houses.

22. Move rig with blocks strung . . .

On some moves, some drilling contractors have found it possible to keep the derrick equipment intact when laying down a jack-knife derrick rig. It is obvious that from this type of move that considerable money will be saved over the type of movement which reassembling of the equipment will be necessary. In this case the blocks remain strung up, the kelly, swivel, the hook and the blocks all remain suspended from the crown. The swivel can be tied back into the derrick and it is possible to stand the kelly and the swivel back as previously described.

23. Design portable equipment . . .

Each rig should be designed for flexible and rapid rig-up. There is a trend towards high-speed drilling equipment which is highly portable. Fast moving trailer type rigs designed for deep wells are more in the picture. Rigs, which are bigger and heavier than their shallower counter parts are being designed which are well unitized and packaged for easy hauling. Fast rigging is money in the contractor's pocket The importance of rig portability is exemplified with the advent of more expensive but more portable type derricks. With the advent of high strength, high alloy steels, weights have been reduced considerably. New high-speed engines and other high-speed rig equipment has drastically reduced equipment weight.

SAVE MONEY RIGGING UP

24. Diagram your rigs . . .

All rigs operated by the contractor should be diagramed in such a manner as to expedite positioning of equipment on the new location. In this way, the trucking contractor and the drilling superintendent or his assistant can have pieces of equipment spotted on arrival. This eliminates a second move of any equipment. With this information the trucking contractor and crewmen can work on several items at the same time.

25. Stagger your crews . . .

The day before the rig arrives, the matting boards on which the substructures, pumps, mud tanks, etc. rest are nailed into position by one crew. The next day, the contractor has trucks at the location at 7 a.m. with one crew to set some of the machinery. The second crew arrives at 9 a.m. By this time there is enough machinery set so that one crew can be tightening and hooking up the chains and tieing-in the water lines and fuel lines. The third crew arrives at 11 a.m. to help set the remainder of the equipment and tie-in other lines.

26. Rig up minimum equipment . . .

Another important factor to consider is that it is generally possible that the rigging-up of the minimum amount of equipment that be set up to drill the surface hole will save money. In some instances it will be possible to drill a surface hole with only a minimum amount of equipment necessary. Frequently there will be a 24-hour waiting period for cement which will provide adequate time for further rigging-up operations before further drilling is begun.

27. Use air hammers . . .

One West Texas contractor uses a pneumatic hammer to drill dead man holes in country plagued with surface rocks. The hammer can serve many uses around the rig such as burying lines, etc.

Continued on Page 138

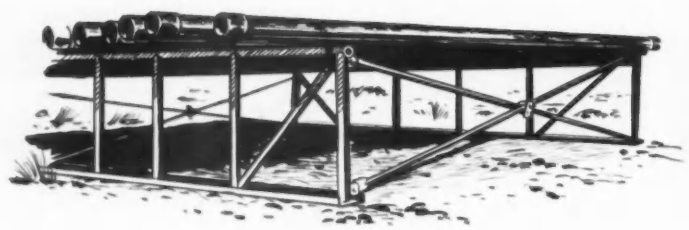


FIGURE 1

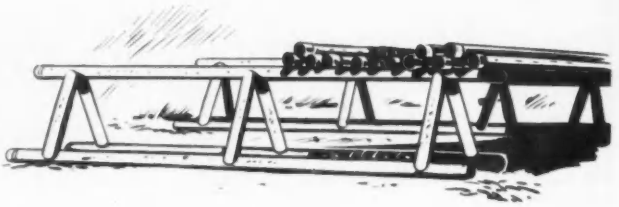


FIGURE 2

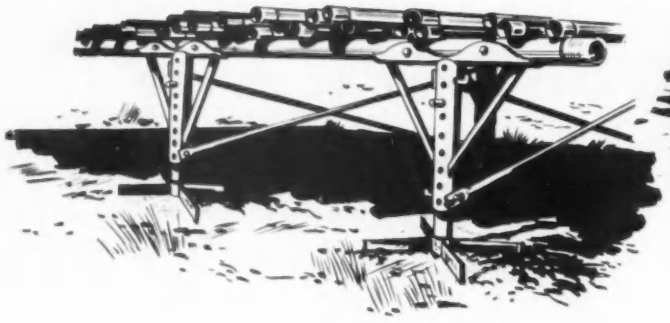


FIGURE 3

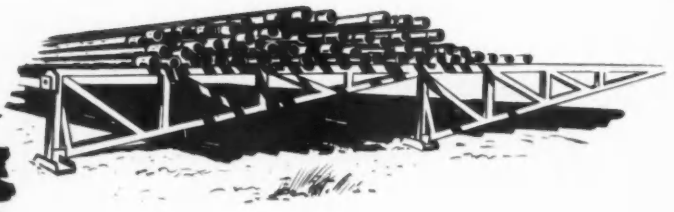


FIGURE 4

28. Flexible pipe racks will pay for themselves . . .

Pipe rack designs possibly offer the most widespread variety in rig-up practice on location. Constructed of timbers, makeshift pipe structures, and heavy steel plate, some racks offer many possibilities economy-wise while others involve considerable fabrication and transport expense. If the drilling contractor is burdened with heavy pipe racks which complicate moves or will not break down into easily moved transport units, it will pay him to consider the redesign or the purchase of inexpensive and flexible units that from the standpoint of rig-time plus minimum transportation—will be amortized after a few moves.

A review of the field of pipe rack design indicates that pipe racks not involving complicated structural details and ones which can be welded together in a short time while field rigging, are the most flexible for saving money. Shown are four widely used varieties in many drilling areas. Figure 1 and Figure 3 are commonly used as extensions or supplementary racks. Although the extension system is not designed to carry loads equivalent to those resting on the main rack system, it provides a useful service when casing strings are to be spotted on locations temporarily. Note how pipe cross members tie in the main legs by diagonally bracing the main skid members with lengths of scrap pipe.

Figure 2 is a widely used variety which has the disadvantage of being cumbersome to transport and difficult at times to level. However, it's sturdy construction is desirable for heavy duty on the flat plains of West Texas and New Mexico.

Figure 3 shows in some detail, pipe pedestals which can be stationed along extension rails, in any number, depending upon the load to be supported. The fairly simple pedestal construction has a telescoping leg which permits rapid leveling of the pipe rack and can be used in many instances as the main pipe rack support after being tied into the pin connection or lug welded to the walkway.

On sandy locations it is advisable to rest the main supports of the pipe racks on either matting or pieces of heavy timber.

Figure 4 is a variety widely used and incorporates a truss arrangement which can be pin connected to the walkway or can be extended at length desired. This unit is commonly used for main support and extension service.

This review by no means represents a complete collection of pipe rack designs. Contractors should consider racks which are designed for transport and fast rigging to best meet their needs.

29. Redesign substructure loads . . .

One company has given considerable thought to combining the substructure and engine mounts into one movable unit. They have successfully reduced the load so that the major rig essentials move in three units. The engine substructure, engine and drawworks move as one unit, the derrick substructure moves as two halves.

Continued on Page 140

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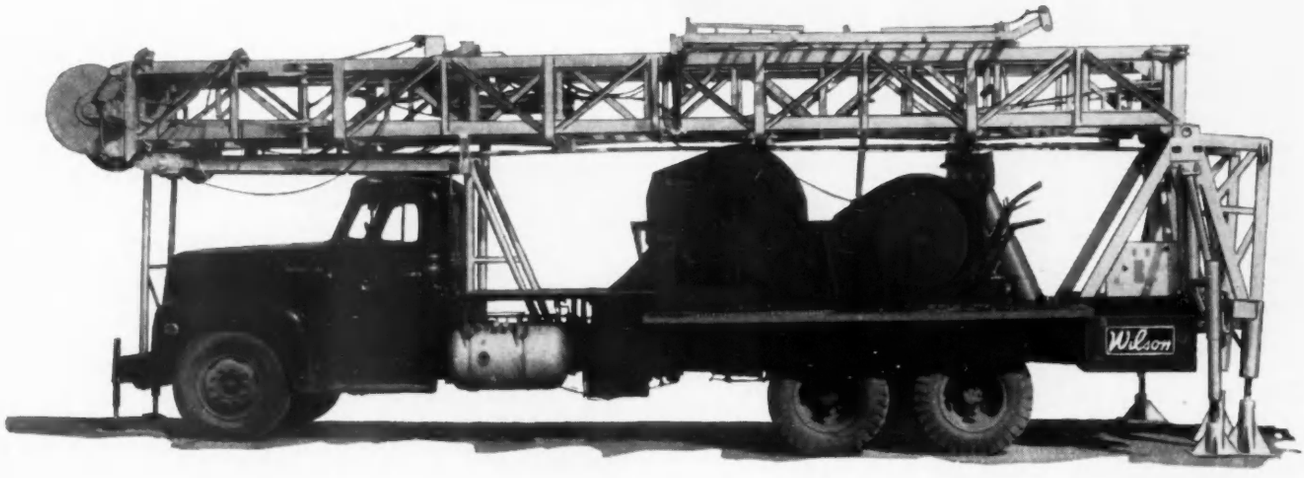

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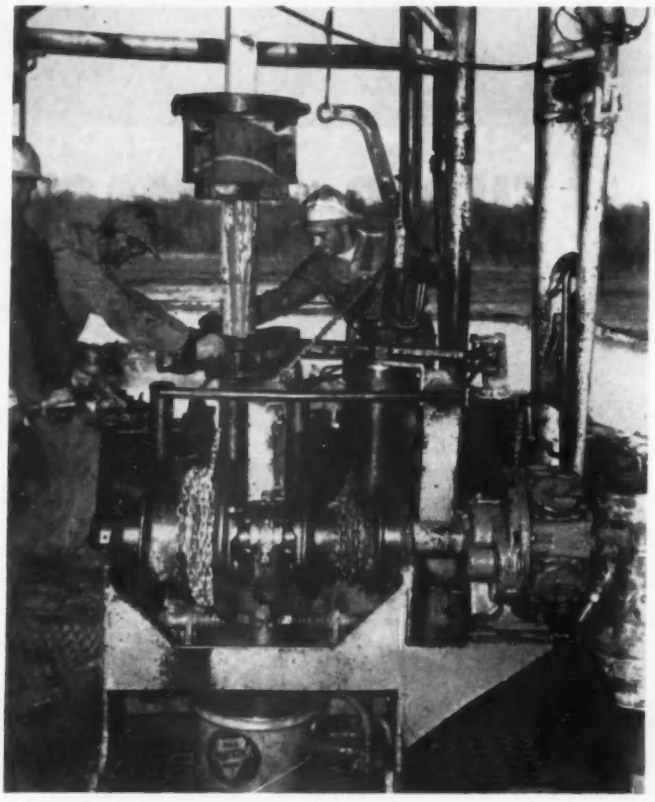
MONEY-SAVING IDEAS



AIR CATWORK in foreground will reduce accident.

30. Use air spinner and catworks . . .

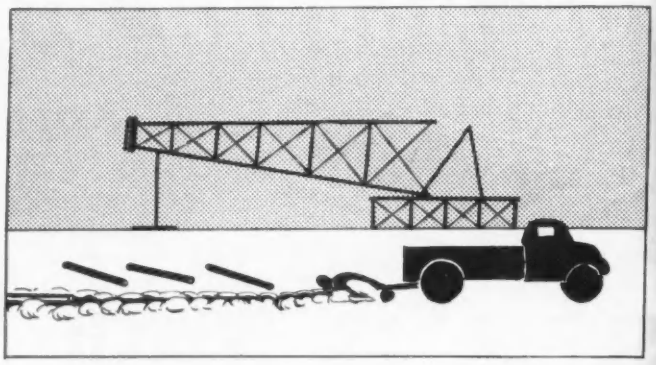
One contractor has mounted an air catwork to the right side of the driller's position. The contractor had in mind a way of effectively reducing his accident rate. Accidents have been reduced and this medium speed machine offers the flexibility of steam power.

31. Use air hoist . . .

Air hoists are receiving considerable attention throughout the oil fields and contractors have put them to various uses. Because of the safety with which heavy equipment can be handled, many contractors have installed small hoisting units on the corner of the derrick floor near the V door. In this position an operator can see everything that is going on on the pipe rack, thus eliminating any blind operation. Bits, logging equipment, core barrels, pipe and other rig equipment can be easily lifted to the floor.

32. Standardize rig parts . . .

Money can be saved by having standby rig equipment or by standardizing rig parts from rig to rig. One contractor has set out to redesign his rigs so that at the time of equipment failure, he can move a pump, or an engine from one rig to another. As long as they are interchangeable, expensive repair bills can be minimized. The mechanic can shop it in contractor's yard and return it to another rig.



33. Use a truck plow . . .

One drilling contractor has found that the use of a small plow pulled behind a truck can greatly expedite the rigging-up operation. By plowing a shallow ditch the fuel and water and electric lines can be buried in a minimum amount of time, eliminating the shovel time required by a roughneck, allowing him to turn to more important phases of work.

34. Mount air hoist in derrick . . .

Considerable savings in rig time per round trip has been made by a new drill collar pullback device. The new equipment enables the derrickman to rack and latch onto drill collars of any size quickly and efficiently, without undue physical effort. This is posible by an air hoist mounted in the derrick. The installation is compact, easily installed, and eliminates the need of rigging up for drill collars.

Continued on Page 142

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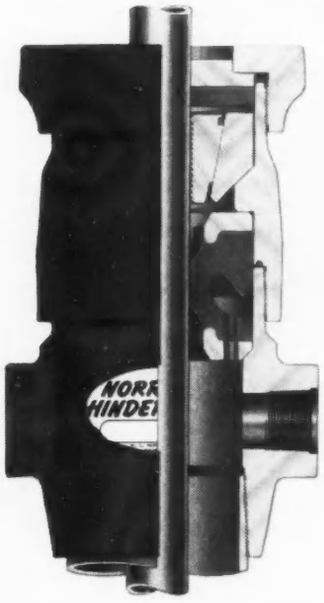
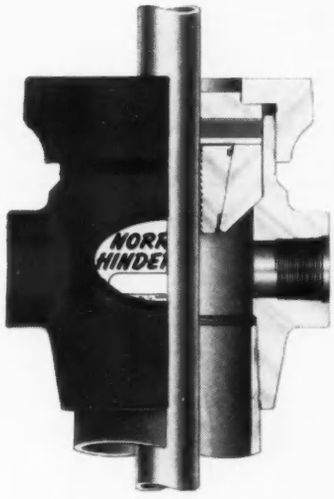
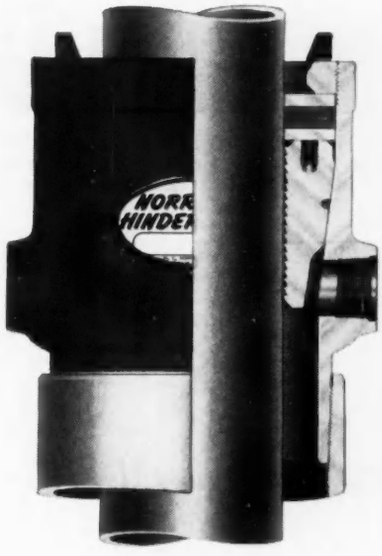


HW 4 IN 1 TUBING HEAD



HW 2 IN 1 TUBING HEAD



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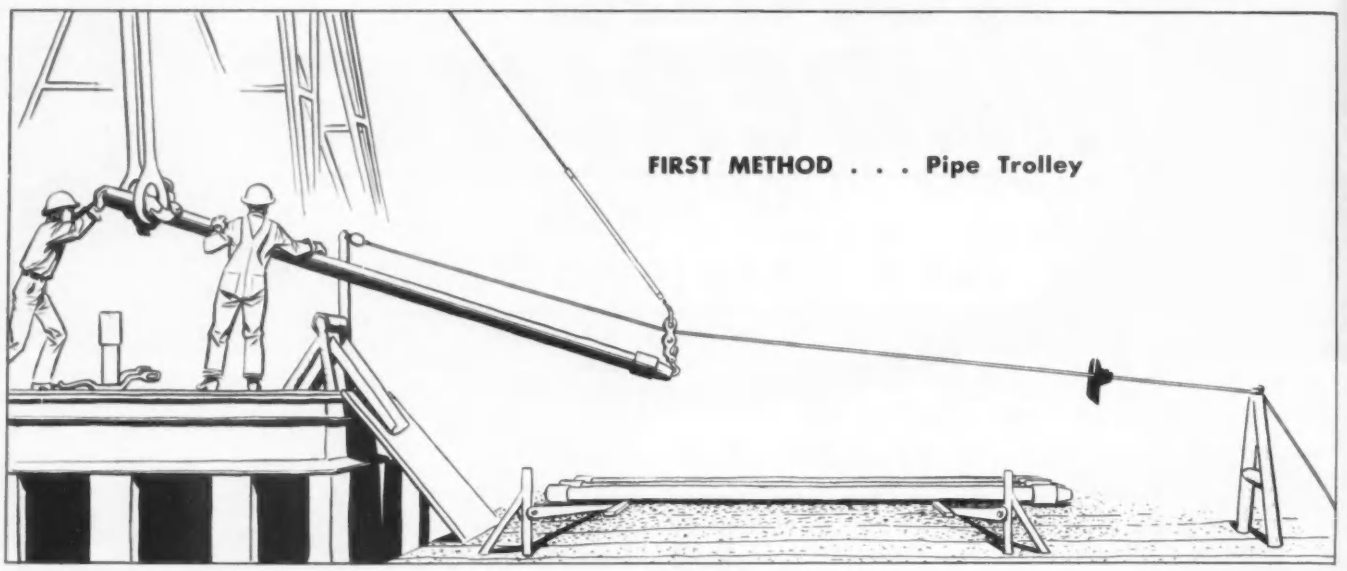
MONEY-SAVING IDEAS

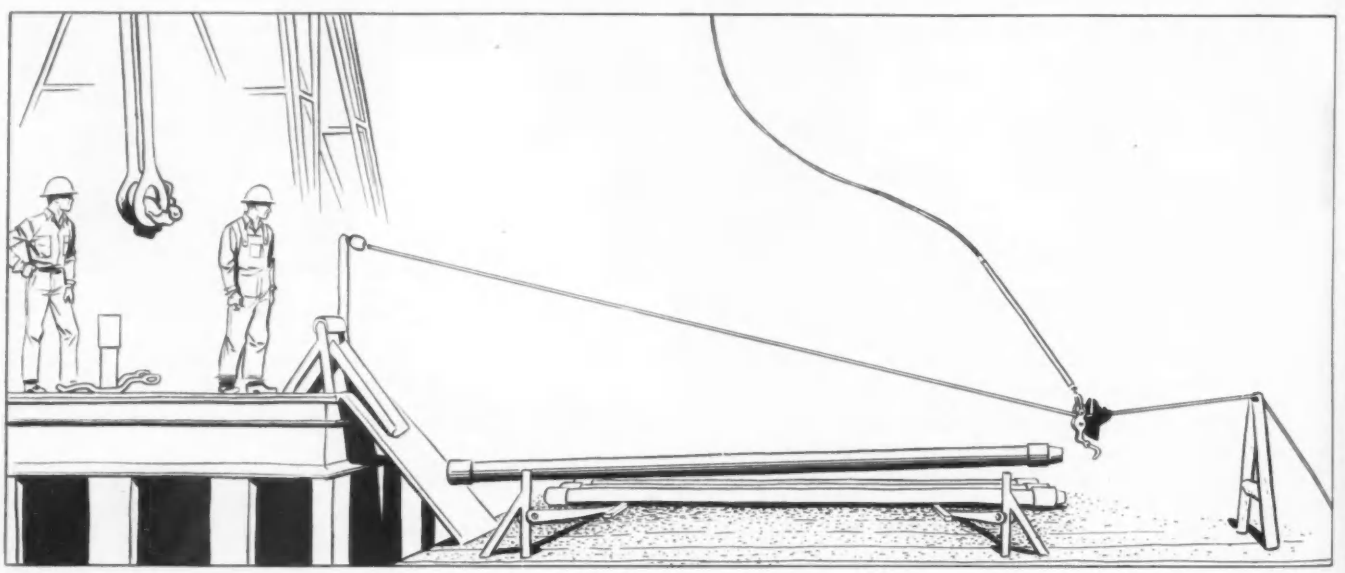
35. SAVE MONEY LAYING DOWN PIPE

LAYING DOWN drill pipe can be a time-consuming chore. Drilling contractors have tried various adaptations of laydown devices which are resulting in considerable savings in time and money. Three of the commonly used methods are presented here:



FIRST METHOD . . . Pipe Trolley

AFTER THE CREWMEN break out a joint of drill pipe, an automatic releasing-type pin hook is placed in the pin end of the pipe. The hook which rides a taut wire line extending from derrick floor to tiedown post at end of walkway carries the pin end of pipe as shown. Box end of pipe passes over roller and is guided down ramp by steel trough.



THE PIPE FALLS as the hook bumps the stop target, causing automatic release of the hook from the pin end of pipe. Hook is then returned to rig floor by a counter-balance attached to line going to derrick.

SECOND METHOD . . . Pipe Chute Type with Dump Wheel

One man can easily work the pipe rack at laydown time with this time and money-saving device patented by Nolen A. Yount, drilling contractor of Beeville, Texas.

Chute for the pipe on the device, which is now used on the rigs of one major producing company, is made of 8⅝-inch casing split in half. The tripod support on the drilling platform is of two-inch pipe, welded to a floor plate at the angle required by the elevation of the platform above the pipe rack. The tripods are further strengthened by a length of brace near the conjunction of the three legs. Twin projections at the top serve as guides when admitting the pipe, and shop-made rollers at the aperture speed the descent down the trough.

The descending trough angles out over the horizontal section of the device, which is supported at three points by pipe welded to floor plates. These plates have their centers cut out in rectangular fashion in order to lessen the weight.

Continued on Page 144

CARDWELL Announces the New K-200 Servicing Hoist

Designed for utmost mobility and operating speed, the CARDWELL K-200 servicing hoist meets your needs for a lightweight, inexpensive 200-H. P. hoist.

The design of the K-200 embodies the simplest of design and operation. Air controls operate the air friction clutches in the main drum, optional sandline drum and rotary drive. CARDWELL air friction drum clutches give fast, positive engagement under all operating conditions and provide free-spooling drums for fast dropping of the block.

A 65-foot or 55-foot double leg telescoping pipe mast is available.

FEATURES

CARDWELL air friction clutches in main drum, optional sandline drum and rotary drive.

Transmission provides four-speeds forward and one reverse to both drums.

Free-spooling drums, mounted on double row, self-aligning bearings.

65-foot or 55-foot double leg mast telescopes and folds over the hoist. Mast is raised and extended by line from winch which is driven by truck engine.

K-200 is available with GM 6031-C or Waukesha 145GKU engine, and can be mounted on a WC-2264 White, RF-195 International or 800-Ford truck.

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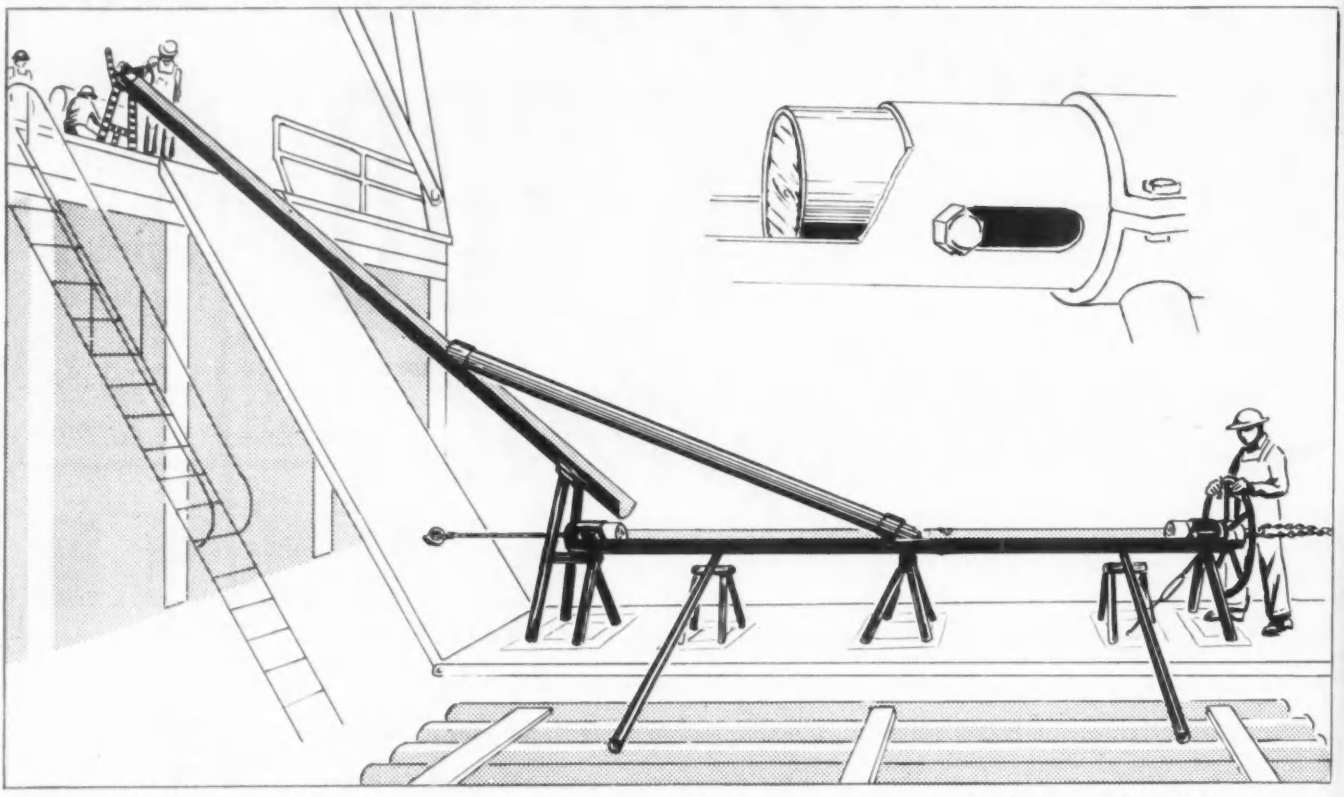


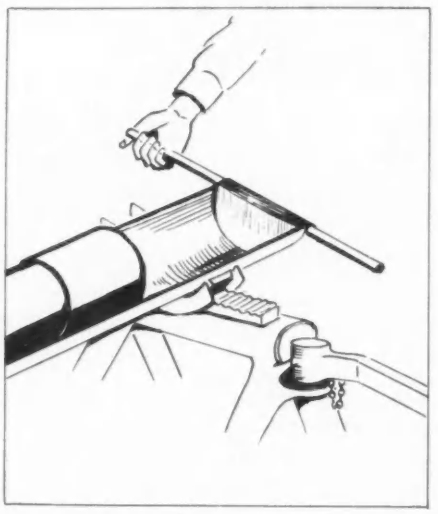
PIPE SLIDES down trough where it encounters bumper to absorb shock. Once at rest, the pipe is dumped by wheel operator at right. Bumper is shown in enlarged insert above.

As the joint of pipe hurtles into the horizontal trough, it collides at the far end with a wooden bumper-block backed up by a heavy coil spring. (Insert drawing shows the slotted trough-end and bolt which holds the string in place.) Purpose of the block is to protect the pipe end. It is shop-fashioned and replaceable. A similar block is used at the other end of the trough to absorb the force of the kick-back.

Once at rest, the pipe is dumped by means of the wheel, being guided into place on the rack by two detached supports fixed to lengths of pipe which can be adjusted to fit the height of the pipe on the racks.

THIRD METHOD . . . Trough Technique

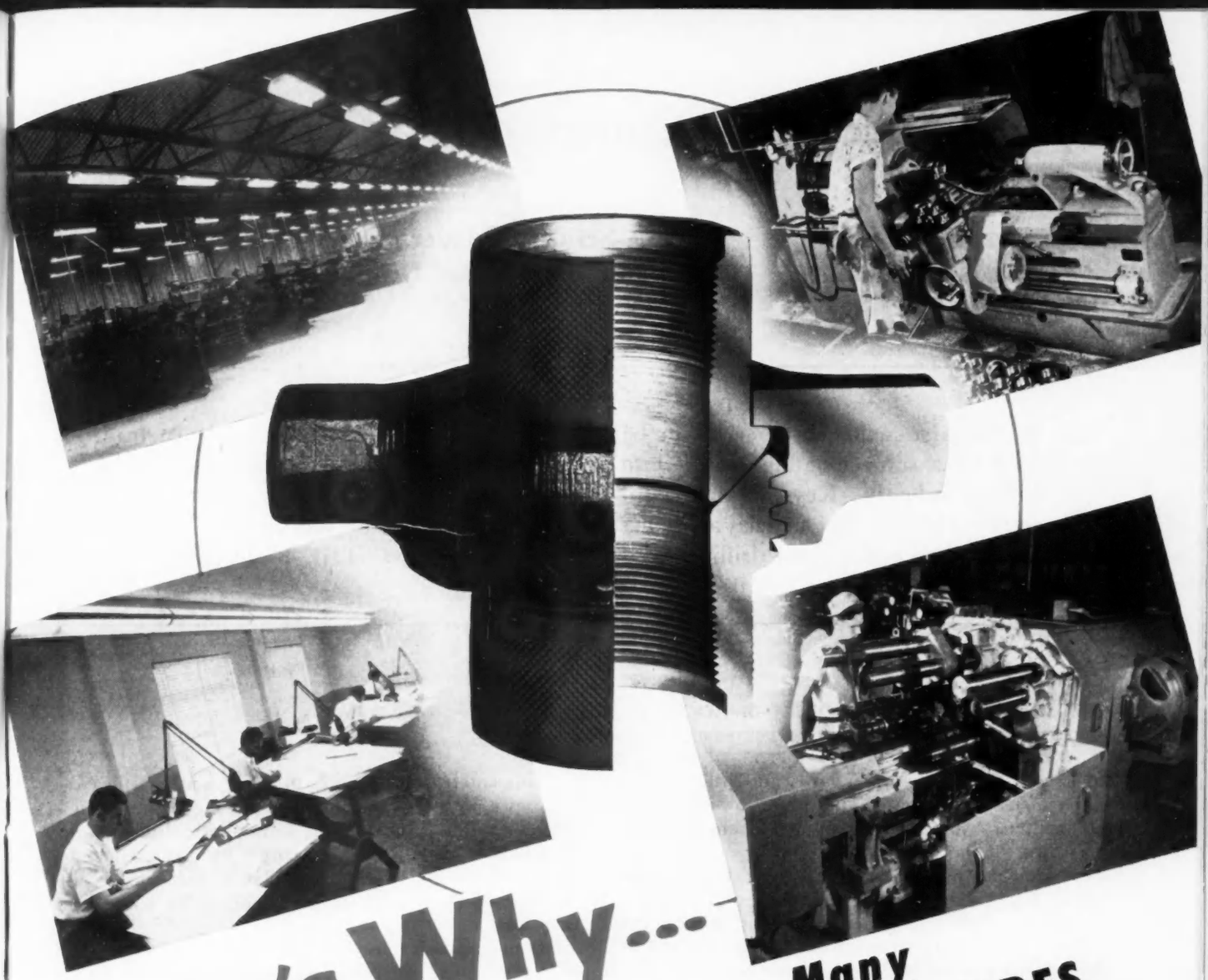
The third method used to lay down drill pipe, uses a trough or chute technique similar to the one just described in the second method, except that the dumping device for rolling the pipe over on the pipe rack has been fabricated from a "rack gear" welded on the support connecting the inclined and horizontal troughs. Semi-circular matching gears conforming to the curvature of the horizontal trough are welded to the extremities of the chute. On the pipe rack end, a one-inch pipe handle is used to tip the trough and dump the pipe. A bumper plate is welded to the back of the trough and is cushioned with a rubber plug.



What about drilling technique?

The successful drilling of an oil well today is dependent upon the efficient use of modern drilling techniques and the intelligent use of a number of highly developed and integrated drilling machines. This presages that the drilling contractor is cognizant of the money that can be realized from preventative maintenance between overhaul periods. But such cost reduction efforts will not be complete unless you analyze your drilling technique and the cost contributing factors.

Increasing bit footages and penetration rates is a primary means of improving drilling efficiency. This will be described by three of the industry's well known engineers in "Keys to Successful Competitive Drilling."—**The End**



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Keys to Successful Competitive Drilling

PART 1

A Series on Modern Drilling Technology
Introduction and Drilling Economics

This is the first article in a series to be presented on a subject of high interest to the drilling industry—Keys to Successful Competitive Drilling. The articles are being written by three well known drilling engineers. Increasing bit footages and penetration rates is the primary means of improving drilling efficiency. How this can be accomplished will be told in this and the following articles.—THE EDITOR.

By ROY A. BOBO, Director, **ROBERT S. HOCH,** Engineer, and **George S. ORMSBY,** Engineer, Drilling Engineering Division, Phillips Petroleum Company, Houston

The annual cost to the oil industry for drilling wells represents a staggering figure. The trends toward deeper depths continues, with resultant disproportionate rise in drilling costs.

Faced with the high expenditure for drilling, many companies, both collectively and independently are investigating new or different means of sinking holes in the earth. Until better methods are available, those in industry that are responsible for drilling operations must constantly strive to improve drilling efficiency with present methods. This becomes all the more important in view of the total drilling cost, wherein a small increase or decrease in efficiency can affect the annual total by tens of millions of dollars.

In order to bring about improvements in drilling, it is first necessary to understand the basic principles of drilling economics and sound drilling engineering. The purpose of these articles is to aid in understanding those principles.

Analyzing well costs. The total cost of drilling any one well can be divided into *non-recurring* costs and *daily operating* costs.

- **Non-recurring costs** include those that are incurred only once during the drilling of each well. These include moving, laying lines, running casing, etc. In case of a turnkey contract, non-recurring costs would also include the cost of casing, cement, logging, perforating, etc.
- **Daily operating costs** include those charges the total of which varies almost directly with the number of days required to drill the well. These consist of crews, repairs, amortization, overhead, insurance, supplies, etc. Because of the daily operating cost, the total for drilling a well rises rapidly as the number of days spent on the well increase. If the non-recurring costs are comparatively low, the total expenditure will be closely proportional to the number of days required to drill the well.

Representative distribution of accumulated total costs are shown for a typical slim hole rig in Figure 1, medium-sized land rig in Figure No. 2, and offshore drilling barge in Figure 3. Non-recurring charges are represented by the horizontal lines. Graphs similar to these are in use by some operators and are invaluable as an aid to cutting costs.

Major emphasis must be placed on the proper items to effect maximum cost reduction. For instance, it is readily observed from Figures 1, 2 and 3 that, once rigged up, the expense of operating a rig for one day is approximately the same whether 3000 feet or only 10 feet of hole are drilled. It would be folly to concentrate major cost control efforts on the conservation of rags, hand cleaners, small hand tools, etc., if the same energy applied to increasing drilling efficiency would save one day's rig time—usually equivalent to the purchase price of several month's supply of the small items that often are important to the morale of the drilling crew.

The most practical approach in drilling the most hole per dollar spent is to drill the most hole per rig operating day.

Evaluating drilling performance. The success in making the cheapest hole depends upon the ability of the contractor to achieve the optimum relationship between the following factors (assuming the drilling fluid program is not governed by the contractor):

- Average bit penetration rate.
- Bit footage.
- Rig cost per day.
- Round trip time required with each bit.
- Bit purchase or rental cost.

The "cost per foot" is related to these factors as follows, and should be used when evaluating the perform-

Total costs for slim hole rig . . .

Total costs for medium-size land rig . . .

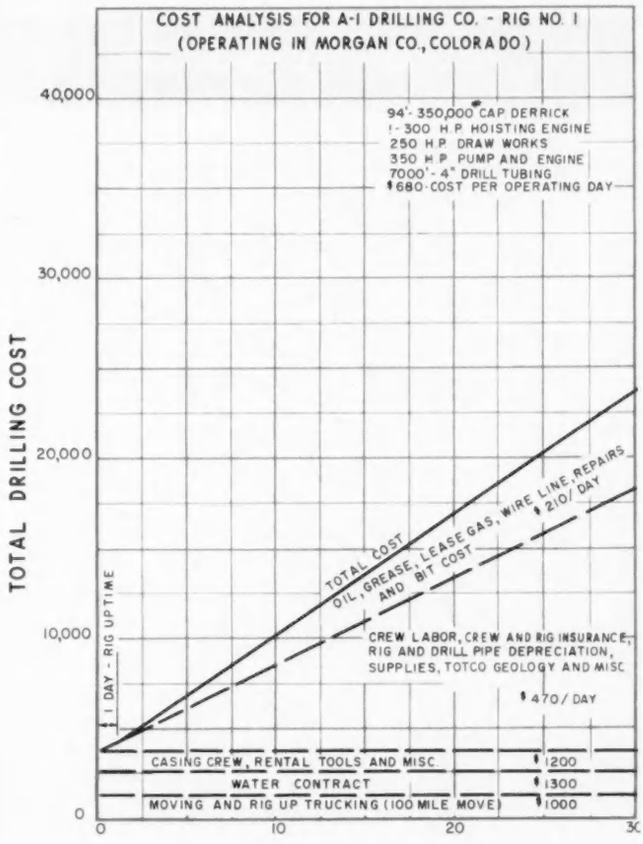

COST ANALYSIS FOR A-I DRILLING CO. - RIG NO. 1
(OPERATING IN MORGAN CO., COLORADO)
94'- 350,000# CAP DERRICK
1- 300 H.P. HOISTING ENGINE
250 H.P. DRAW WORKS
350 H.P. PUMP AND ENGINE
7000'- 4" DRILL TUBING
$680- COST PER OPERATING DAY
TOTAL DRILLING COST
40,000
30,000
20,000
10,000
0
1 DAY - RIG UP TIME
TOTAL COST OIL, GREASE, LEASE GAS, WIRE LINE, REPAIRS AND BIT COST $210/DAY
CREW LABOR, CREW AND RIG INSURANCE, RIG AND DRILL PIPE DEPRECIATION, SUPPLIES, TOTCO GEOLOGY AND MISC. $470/DAY
CASING CREW, RENTAL TOOLS AND MISC. $1200
WATER CONTRACT $1300
MOVING AND RIG UP TRUCKING (100 MILE MOVE) $1000
0
10
20
30
DAYS ON LOCATION

FIGURE 1

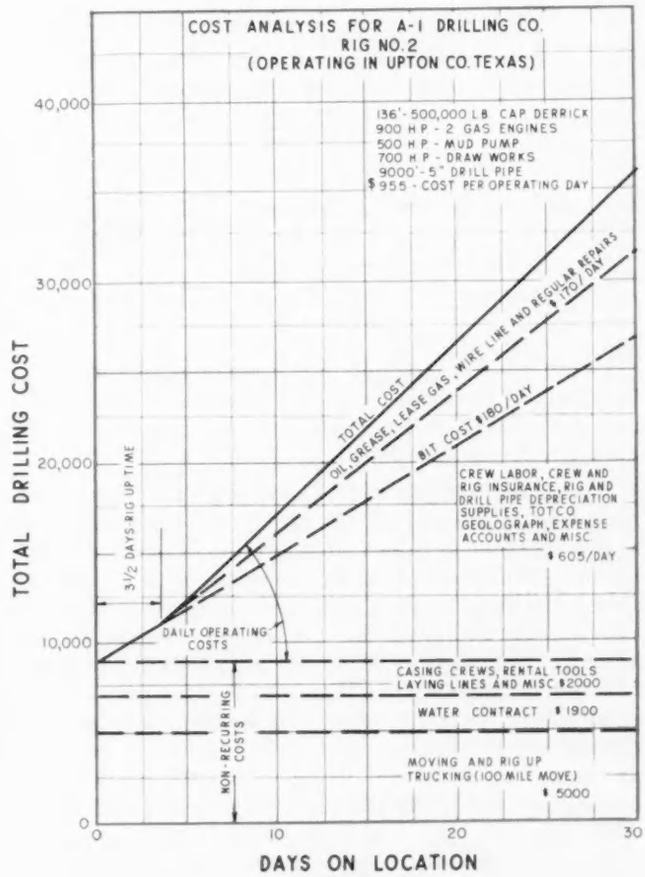

COST ANALYSIS FOR A-I DRILLING CO.
RIG NO. 2
(OPERATING IN UPTON CO. TEXAS)
136'- 500,000 LB. CAP. DERRICK
900 H.P. - 2 GAS ENGINES
500 H.P. - MUD PUMP
700 H.P. - DRAW WORKS
9000'- 5" DRILL PIPE
$955 - COST PER OPERATING DAY
TOTAL DRILLING COST
40,000
30,000
20,000
10,000
0
3 1/2 DAYS RIG UP TIME
TOTAL COST OIL, GREASE, LEASE GAS, WIRE LINE AND REGULAR REPAIRS $707/DAY
BIT COST $180/DAY
CREW LABOR, CREW AND RIG INSURANCE, RIG AND DRILL PIPE DEPRECIATION SUPPLIES, TOTCO GEOLOGRAPH, EXPENSE ACCOUNTS AND MISC. $605/DAY
DAILY OPERATING COSTS
NON-RECURRING COSTS
CASING CREWS, RENTAL TOOLS LAYING LINES AND MISC $2000
WATER CONTRACT $1900
MOVING AND RIG UP TRUCKING (100 MILE MOVE) $5000
0
10
20
30
DAYS ON LOCATION

FIGURE 2

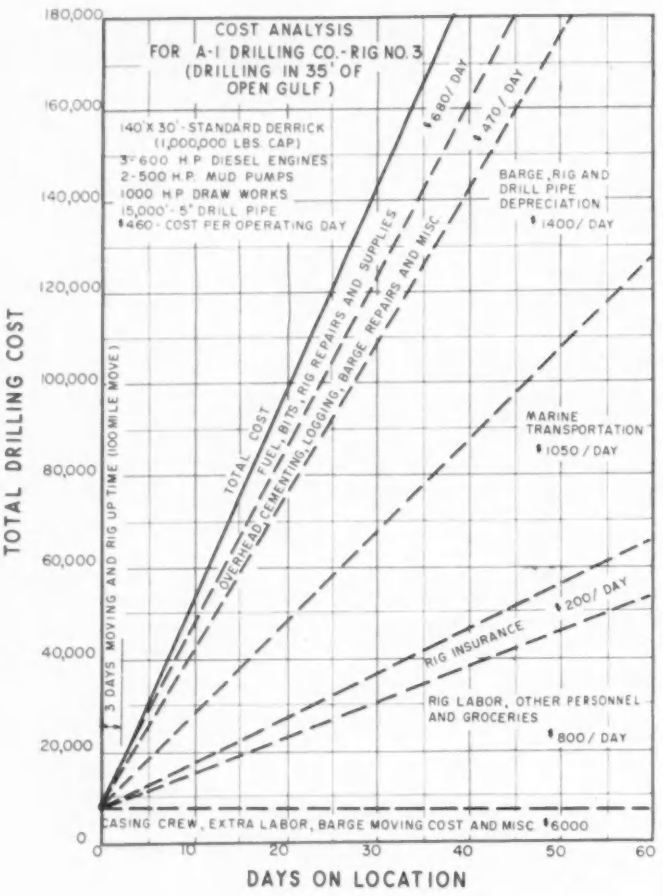


FIGURE 3

ances of various types of bits and drilling techniques:

$$\text{Average Cost per Foot} = \frac{(\text{Rig Cost/Hr.})\ (\text{Trip Hrs.} + \text{Rotating Hrs.}) + (\text{Bit Cost})}{\text{Bit Footage}} \qquad (1)$$

Figure 5 is a nomograph of this relationship and can be used by field personnel in their evaluation of drilling bits and techniques. An example showing how to use the nomograph is included with the figure.

Bit records from the Gulf Coast and West Texas areas have been analyzed and the cost per foot for each bit, as was determined from Figure 5, plotted versus the footage life of the bit for various amounts of trip time. An average of these values is presented on Figure 4. Note that the cost per foot and the rate of cost change are low when 100 feet or more is made with a rock bit; however, for rock bit footages less than 100 feet the cost per foot is high and increases rapidly as footage decreases. Although bit performance should be carefully observed at all times, small changes become critically important as footage life and penetration rate decrease. Note that generally the bits with low footages have low penetration rates; conversely, high rock bit footages ordinarily accompany high rates of penetration.

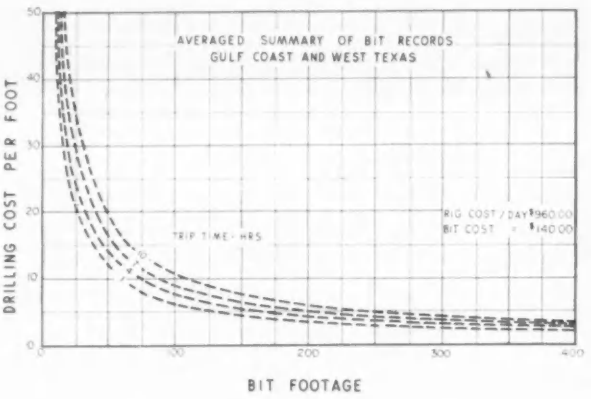

AVERAGED SUMMARY OF BIT RECORDS
GULF COAST AND WEST TEXAS
DRILLING COST PER FOOT
BIT FOOTAGE
TRIP TIME - HRS.
RIG COST / DAY $960.00
BIT COST = $1400.00

FIGURE 4

Total cost for offshore drilling barge

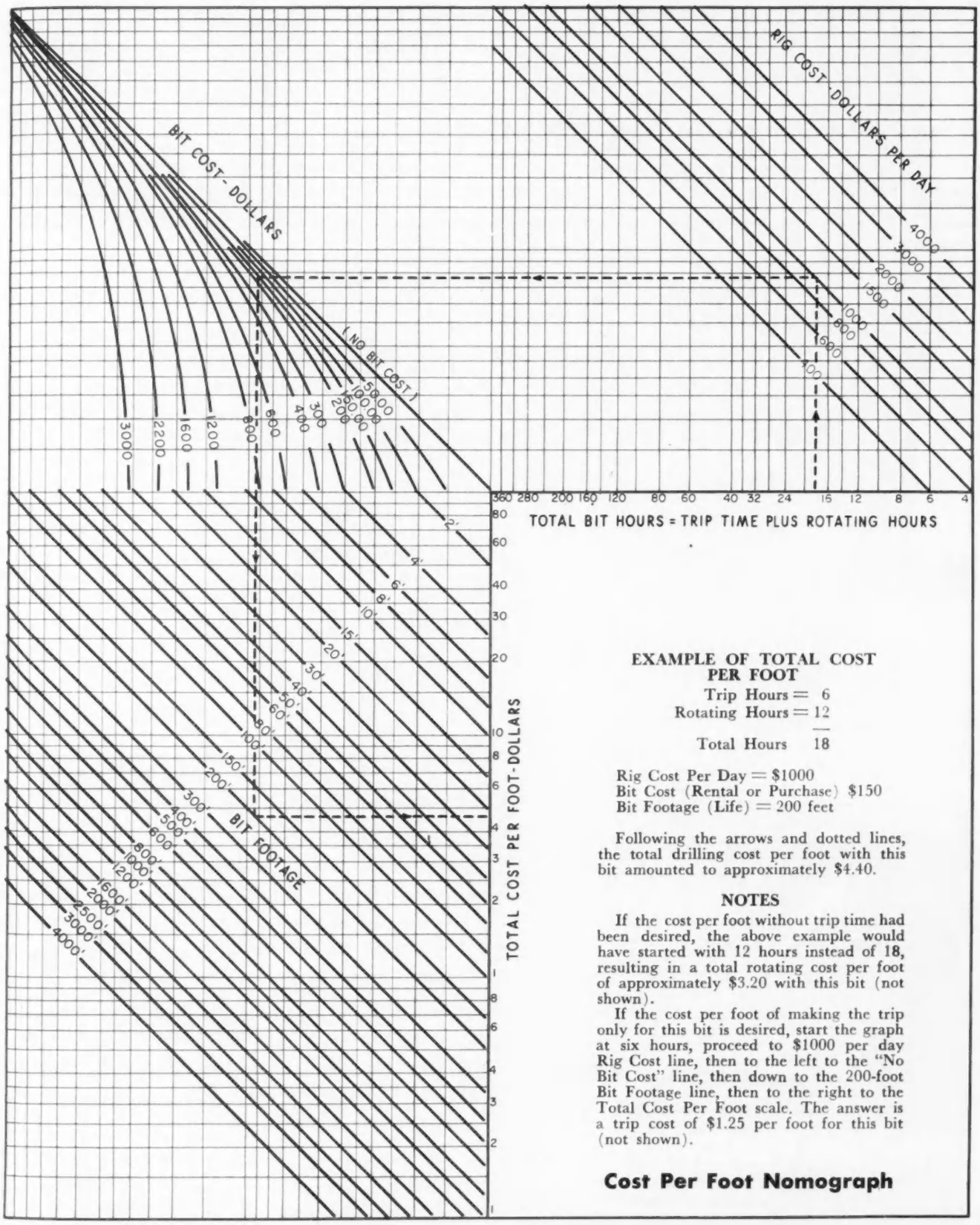
(Figure 5 on Page 151)

The foregoing indicates that any reduction in bit performance at footage rates below 100 feet will result in abnormally high footage costs. Inspection of drilling well records shows that bit footages and penetration rates usually do drop drastically at greater depths. Quite often these reduced bit performances are out of all proportion to changes in the drilling characteristics of the formations being penetrated. This observation leads to the conclusion that an attitude of resignation to poor drilling performance at the greater depths often prevails on the part of drilling crews, supervisors, and executives. It must be understood that the same principles that apply to increasing penetration rates in shallow holes also apply to deeper holes and that the opportunity for savings is even greater in the latter.

The importance of increasing bit performance is the fundamental factor in increasing drilling efficiency and reducing costs. The factors which affect rock bit performance will be presented as a series in successive issues of WORLD OIL for the purpose of improving drilling operations. They will be presented in the following order:

- Formation characteristics and rock bit design
- Bit size selection
- Bit weight and rotary speed
- Drilling fluids and hydraulics
- Diamond bits and specialty bits

Continued on Page 151



EXAMPLE OF TOTAL COST PER FOOT

Trip Hours = 6
Rotating Hours = 12
Total Hours 18

Rig Cost Per Day = $1000
Bit Cost (Rental or Purchase) $150
Bit Footage (Life) = 200 feet

Following the arrows and dotted lines, the total drilling cost per foot with this bit amounted to approximately $4.40.

NOTES

If the cost per foot without trip time had been desired, the above example would have started with 12 hours instead of 18, resulting in a total rotating cost per foot of approximately $3.20 with this bit (not shown).

If the cost per foot of making the trip only for this bit is desired, start the graph at six hours, proceed to $1000 per day Rig Cost line, then to the left to the "No Bit Cost" line, then down to the 200-foot Bit Footage line, then to the right to the Total Cost Per Foot scale. The answer is a trip cost of $1.25 per foot for this bit (not shown).

Cost Per Foot Nomograph

FIGURE 5

TO BE CONTINUED

Richard L. Dailey, petroleum training specialist for the University of Texas Extension Division, is well known in drilling circles for his ability to get across important points that encourage good operating practices. The article presented here was developed from excerpts from a motion picture short entitled "Running and Handling Drill Pipe." This movie was sponsored jointly by the American Petroleum Institute, American Association of Oilwell Drilling Contractors, and the University of Texas Petroleum Extension Service. This is the first part of a series of articles to be run in future issues of WORLD OIL. —The Editor

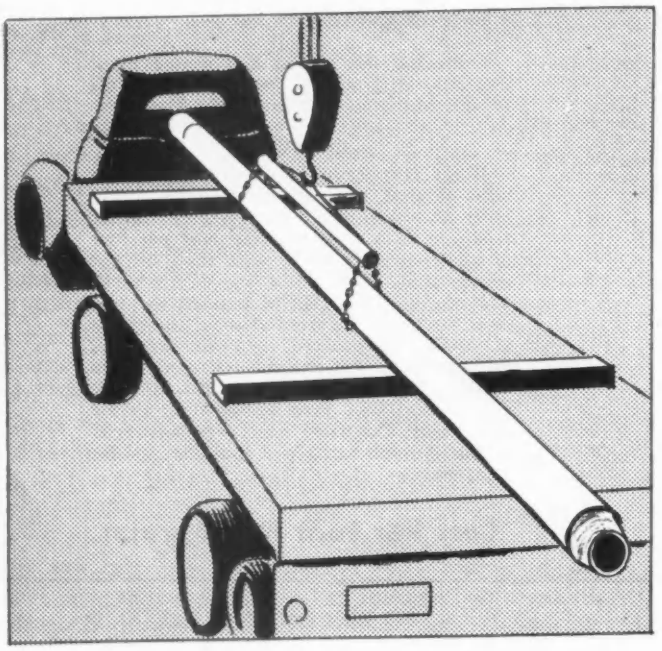
SAVE MONEY by reviewing

How to Run and Handle Drill Pipe

- Transporting pipe
- Unloading pipe
- Preparing pipe to run
- Snubbing drill collars

PART 1

By **RICHARD L. DAILEY,** Training Specialist,
The University of Texas, Extension Division, Austin



TRANSPORTING PIPE

One of the best trucks used in hauling collars is one that is equipped with a flat bed trailer. Pole trailers do not allow for a center support if one is needed. On flat bed trailers, the strips that the collars lie on can be adjusted to equally distribute the weight.

Some truckers say that only two strips are needed if the stripping is spaced in the center of each half of the collar. They say, too, that the center of the truck bed flexes while in transit and, with three strips, forces the collar to bend in the middle.

If three strips are used, the center strip should be high enough to carry its share of the load. Otherwise the collar will be bent down in booming at that point.

Continued on Page 156

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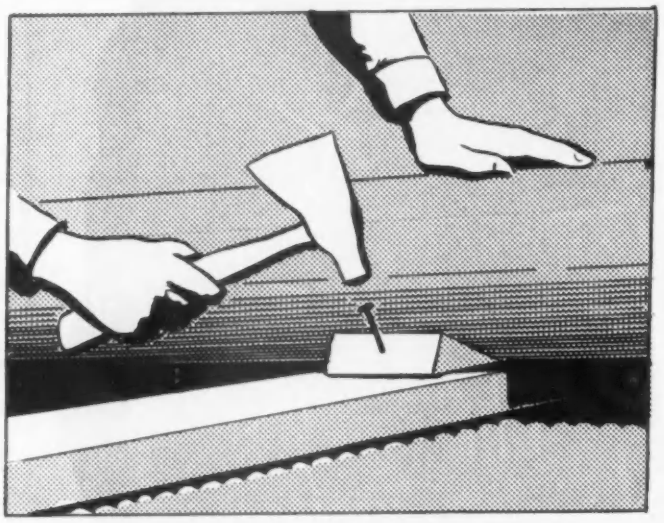
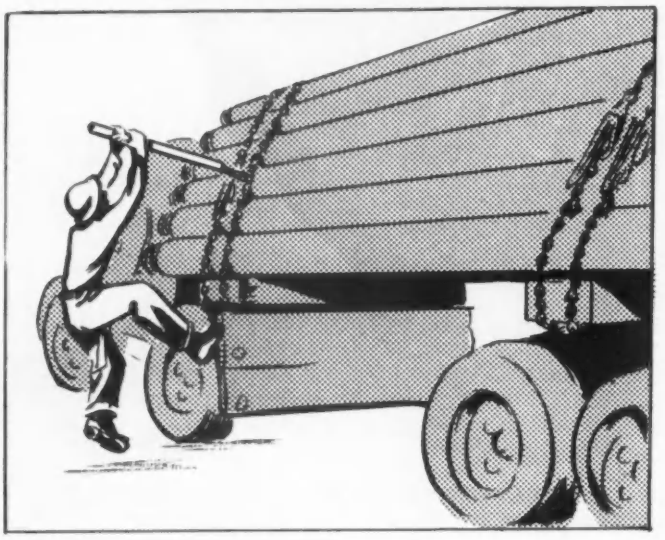
CARING FOR DRILL PIPE



Block the load . . .

Wedge-shaped blocks, large enough to take nails without splitting, can be nailed to the stripping as substitutes for adjustable lugs and to keep the collars from rolling. But for further insurance against the collars rolling, two chains are passed around the collar and are boomed down directly over the strips.



Practice safety . . .

Booming pipe and collars is important and not dangerous unless made so by a careless driver who could easily fall and hurt himself if the cheater should slip off the boomer, as he hangs over the edge of the truck. The load has been properly stripped, blocked, and boomed down. A red flag is used to serve as warning to passing motorists.

After the trucker has driven far enough to settle the load, he should check his load and boomers. Boomers should be placed on the load for checking and tightening if need be on the side of the truck away from traffic.

UNLOADING THE PIPE

Even though the truck has been loaded with care and everything has been done to protect the load from damage in transit, the trucker's responsibility has not ended. It will not end until his load is resting properly on the rack at its destination.

Roll off one at a time . . .

There is no trick to unbooming the load when the truck is on level ground and the collars are blocked. It's better if the collars are rolled off one at a time and gotten out of the way before another is unloaded.

Collars weighing a ton apiece slamming together can cause considerable damage to the shoulders; especially if they should hit at an angle. Thread protectors offer some protection in this case.

Keep load level . . .

When the truck is on uneven ground and the load not properly blocked, anything can happen. Frequently the collars roll off of the truck at the same time. In such instances, the collars could be damaged and the men around the rack injured. Skids between the truck and the rack must be strong enough to hold the rolling load and the strips on the rack must be heavy enough to carry the collar's weight without crushing. It's better if pipe racks are level, and the tiers exactly the same height. This keeps the collars from bowing in the middle and becoming permanently bent or weakened.

Strings of "spaghetti" or "slim hole" collars and pipe are much lighter, and will bend more easily. Greater care in handling was required. Unless the collars are absolutely straight, the compression they are subjected to in the hole will bend them still more, possibly ending up in a bent "fish" that is extremely difficult to retrieve.

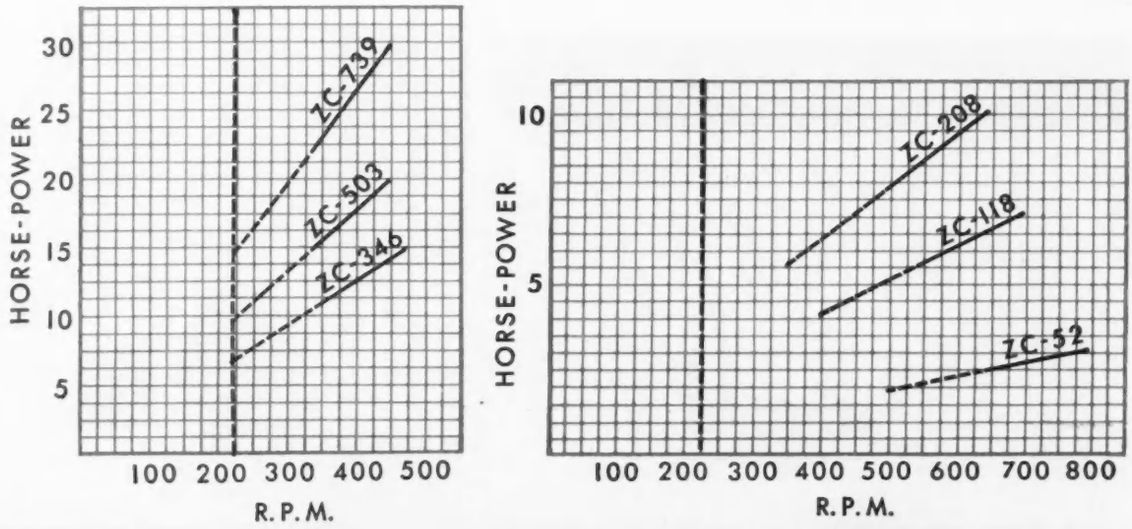
But—large or small—drill collars ought to be kept under complete control while unloading or severe damage may result.

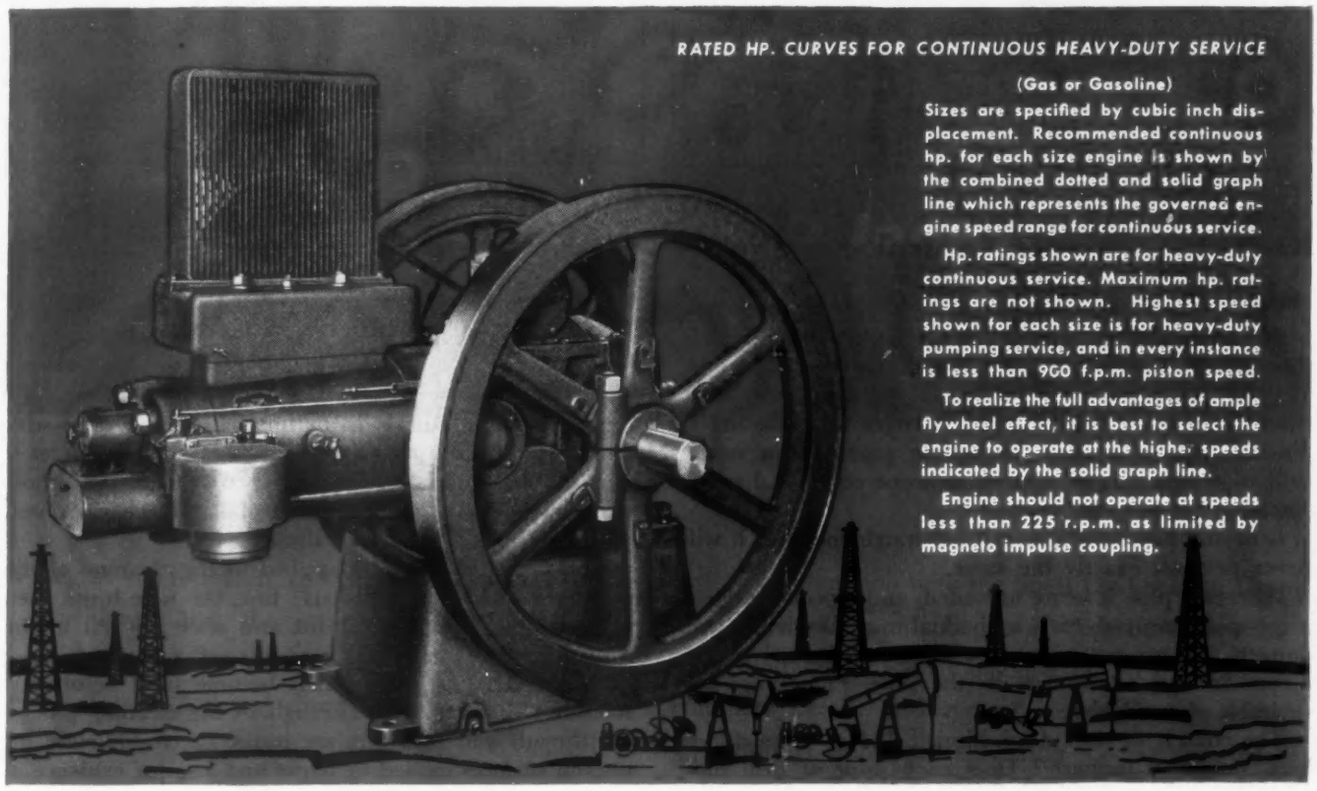
Inspect pipe for damage . . .

Before drill pipe is run after being brought in from another location, the pipe should be visually inspected for damage. It helps if tool joints are cleaned, inspected and lubricated.

Protectors placed on the boxes and pins before the pipe is transported will preserve the pins and boxes from damaging blows. Carefully looking through each joint of pipe will prevent obstructions, or "rabbits," from remaining in the pipe to later plug the bit. Extra trips tend to shorten the life of the pipe and it might be good insurance to straighten, repair, or discard all damaged pipe and tool joints. The life of the pipe and tool joints can be greatly extended if they are given a little care between jobs.

Continued on Page 158





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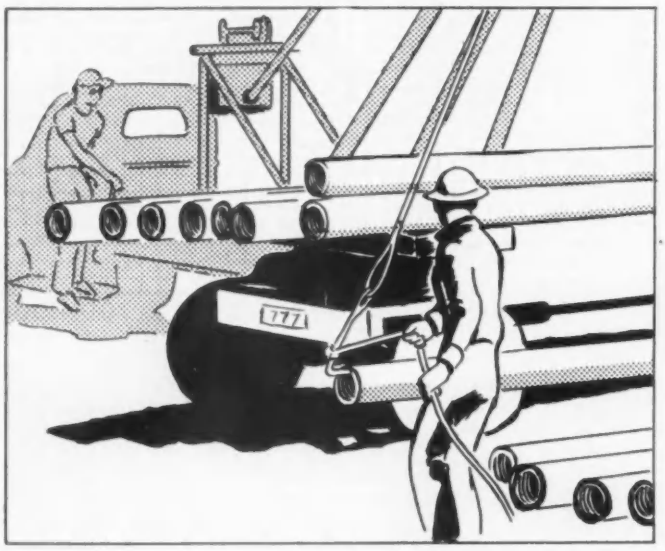
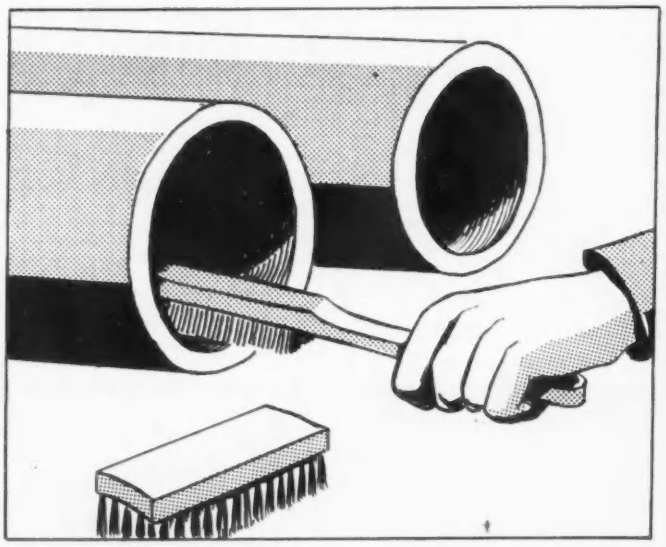
CARING FOR DRILL PIPE





Keep load under control . . .

Like drill collars, drill pipe should be kept completely under control as it comes off the truck. After all, joints this size weigh only a little less than 300 pounds. To allow 15 or 20 joints to "get away" is like turning loose a big truck without a driver. Another danger in unloading is playing hopscotch over the rolling pipe. When heavy drill pipe runs out of control, someone could end up in the hospital, seriously injured.

Bent and damaged pipe can be straightened but it will never perform exactly the same.

Wherever pipe is being unloaded, and especially where a group is involved, each individual must be alert to the dangers that are ever present—dangers to themselves and others as well as damage to the pipe. Pipe slings are desirable if available.

The contractor should ask himself, "Have these collars been unloaded properly? Does each joint of drill pipe have the same amount of life left in it as when the truck pulled up to the rack?" Handling the pipe with hands will help insure good pipe when you are ready to go into the hole.

Clean the pipe threads . . .

The job of caring for the pipe is continuous. The protectors are removed and a wire brush dipped in suitable solvent is used to remove any heavy accumulation of direct, scale or old thread dope. The job can be done more easily and quickly if the final cleaning is done with a scrub brush since the wire brush has a tendency to leave part of the materials you've tried to get rid of. A thorough inspection of the threads and shoulders will reveal any necessity for repair or discard.

The same procedure is applied to the cleaning of the pin end of the pipe or collars: first, the wire brush then the softer scrub brush. If dirt and scale are left in the threads, well, there's a possibility of galling or false make-up. That is, the threads become tight before the shoulders begin to seal. Throughout the cleaning process the threads and shoulders are inspected continuously for uneven surfaces caused by blows and also for evidence of pitting or cracking. When the cleaning process immediately precedes running the pipe or collars into the hole, thread lubricant is not necessarily applied while the string is on the rack.

PREPARING TO RUN PIPE

"Preparation for running" sometimes means putting tool joints on the pipe in the field. Hatchets should never be used to remove the hard-rubber protectors. The threads can be easily cut, destroying the seal between the total joint and the pipe.

Continued on Page 160

As long as you're searching for new oil, why not take a *good* look? Use the industry's most intelligent approach toward establishing a comprehensive record of each foot drilled and cored during an exploratory test . . . Use Core Lab's double-edged derrick-side service of Well Logging (continuous analysis of drill cuttings virtually concurrent with progress of the drill bit) in combination with the finest On-Location Core Analysis available . . . Copies of Core Lab's new 12-page multi-colored Well Logging Folder (containing complete details and typical regional examples of Graphologs and corresponding Coregraphs) are immediately available. Please make request on your company letterhead and direct to address below.

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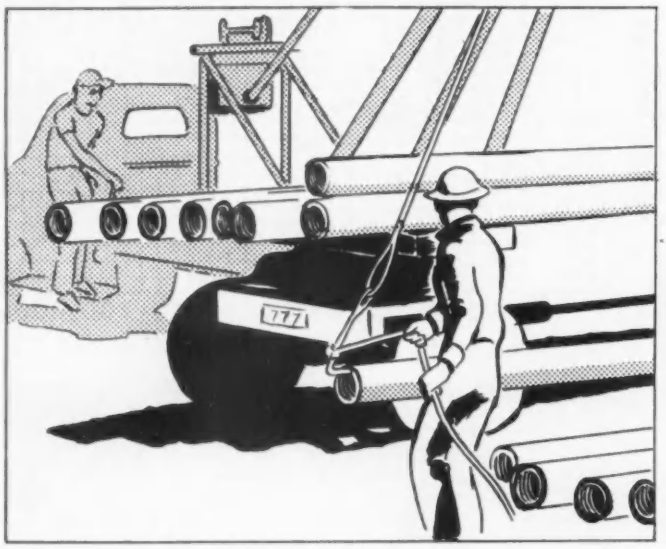
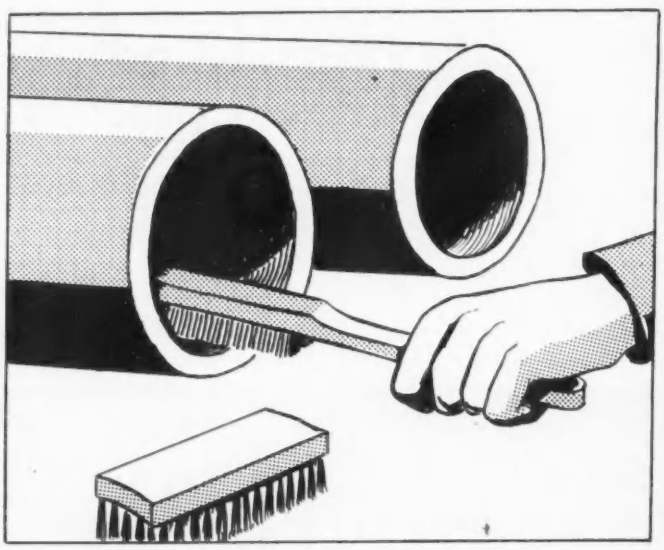
CARING FOR DRILL PIPE





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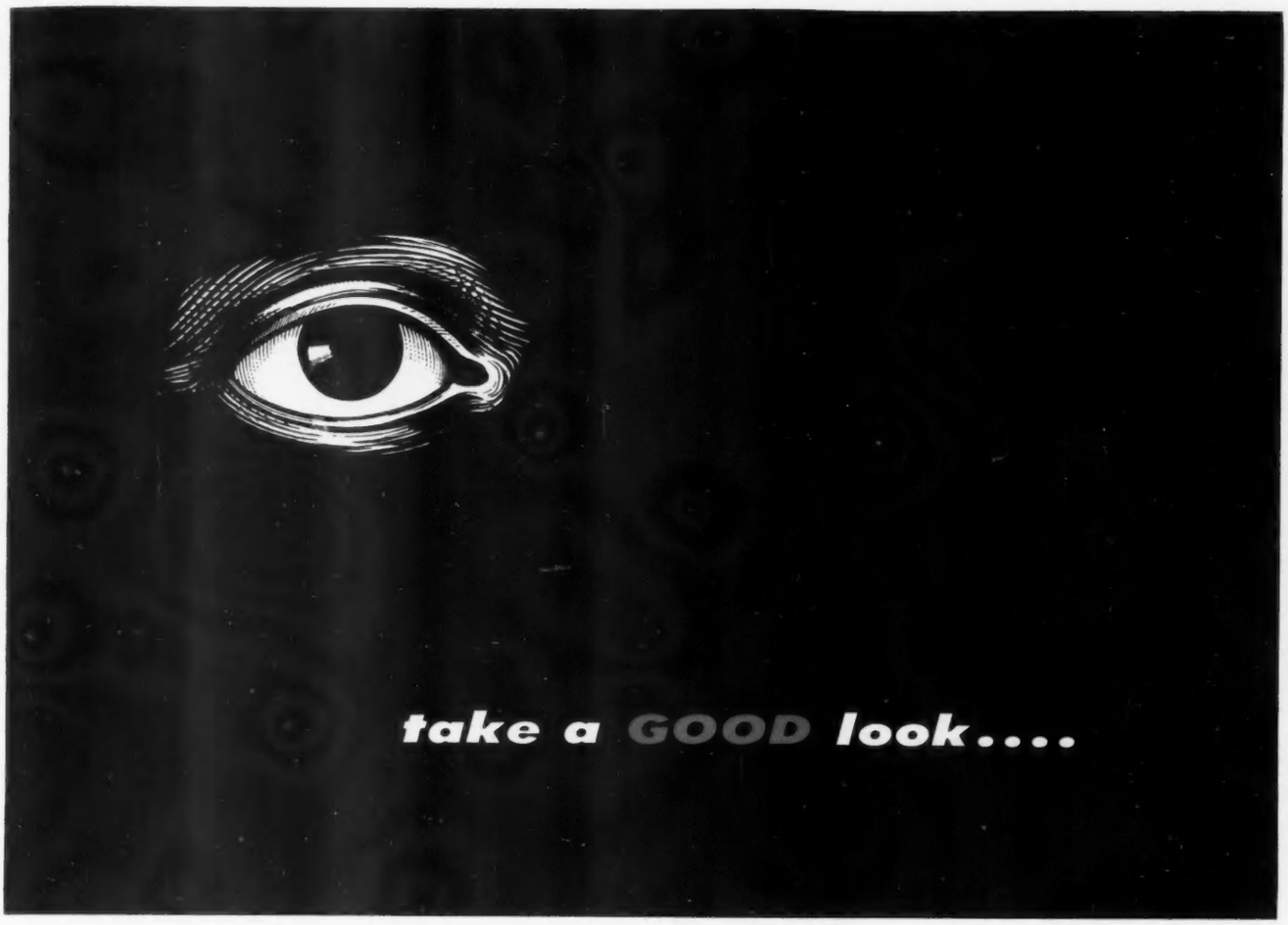

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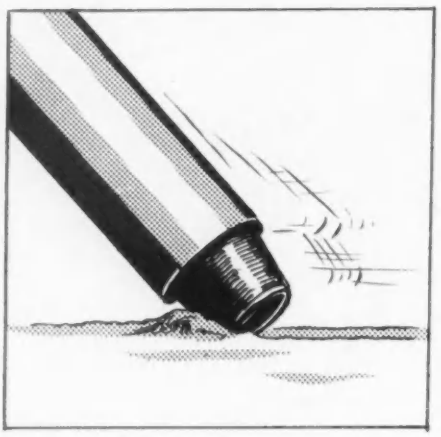
CARING FOR DRILL PIPE

Replace protectors . . .

Just before the collars or pipe are rolled over the walk, and before picking up the string, the protectors are replaced on the threads and boxes and remember it's a good idea to clean the protector, too. Unfortunately, this was not found to be a common practice. But since a great portion of the life of a drilling string depends upon good threads and perfect-sealing shoulders, the use of protectors should be advantageous. The pin especially needs protection. This is the end that drags as the pipe or collar is being lifted into the V-door. It strikes the nails, steel plates, or anything that happens to be on the walk.



On rigs where protectors were not used, special note of the way others handled their pipe and collars to keep from injuring the threads and shoulders. Lowering a lift sub to the walk on a cat line is one way of getting the collar ready to go into the V-door. The sub affords protection to the shoulders on the box end. A protector with a lifting eye might be faster and a bit less clumsy and the sub collar could then be made up on the rig floor.

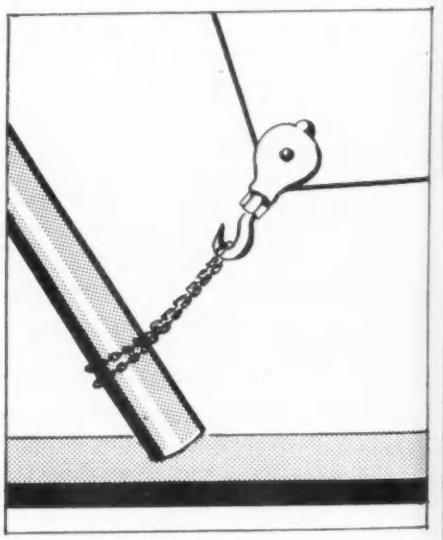
SNUBBING DRILL COLLARS

Usually the bottom-hole collar is equipped with a box on both ends. The use of a dolly or "tail wagon" might be questionable. Here the idea being that the hook on the front of the wagon gouges the threads —the very threads that will help carry the weight of 16 to 20 drill collars in compression. A bit or sub made up on damaged threads or injured shoulders could possibly damage the engaging pin or box of the collar. Result? A possible fishing job.

After the collar has been brought in the V-door, the cat line is removed, and the elevator is latched on and the first collar goes into the derrick. One or more men, grab hold of the loose end of a snub rope, take a turn around the collar, and snub it into the V-door. The snub line is used to guide the collar and prevent it from swinging too far into the derrick. It's easy to picture the damage that two to four tons of steel could do swinging wild into the drawworks.

Another method . . .

Another way to snub the collar into the derrick and to keep the lower end from banging against the ramp is to use a line and trolley. This picture shows the bottom-hole collar being lifted without use of the hook to avoid damaging the inside threads. By simply tightening the line and using the hook, the pin and shoulders of subsequent collars are kept from coming in contact with this ramp's steel surface—a likely source of damage. This method also eliminates the possibility of injuring anyone who might otherwise be handling a snub line.



Part 2 of this series in a coming issue.

Reprints of the Special Report on Modern Methods of Slim Hole Drilling published in the May, July and August 1954 issues of WORLD OIL are now available. Send requests with $1.00 for each reprint to WORLD OIL, P. O. Box 2608, Houston, Texas.

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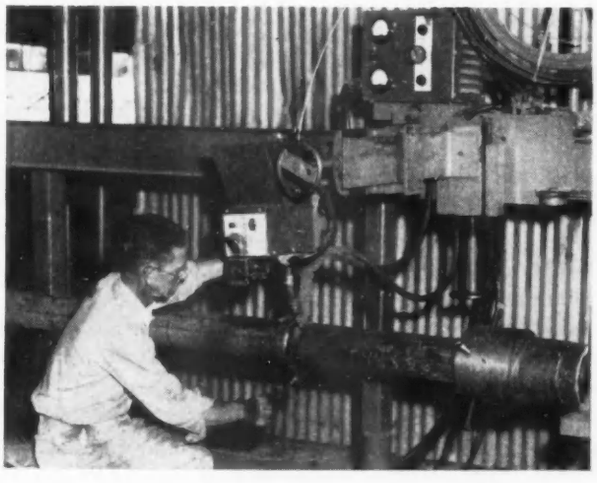

For years, oil men have been stubbing work-worn drill collars to new service by arc welding on additional length.

Electric welding is not new, but until recently this was a slow, tedious process of applying bead-upon-bead by hand. It was subject to human error, which resulted in failures in the field.

Brown Well service eliminates the element of human failure by using the *automatically-controlled submerged arc welder* – the safest, most practical means in use today, which results in the least distortion of any method known.

Call on Brown Well Service to restore new length and life to old drill collars by the *automatic* submerged arc method.

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Representatives for Brown Oil Tools, Houston, Texas

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QUESTIONS and ANSWERS on some practical drilling ideas that will SAVE YOU MONEY

For more than 38 years, drilling and production people have been sending their problems to the editors of WORLD OIL, and its predecessor The Oil Weekly, in the knowledge that all of our resources and facilities are at the disposal of our subscribers. In this era of constantly changing technology, we felt that the compilation of some of these requests would be helpful to the contractor in working out his every day task. The editors of WORLD OIL stand ready to help on any problem not covered herein.

By **PHILIP L. McLAUGHLIN,** Drilling Editor, WORLD OIL

Oil attack rubber on rig . . .

Q. *What can be done to prevent the deterioration of rubber on the rig when oil emulsion muds are used? We have found that some oils are detrimental to pump inserts, rubber hoses, pipe wipers and other rubber equipment.*

A. In the early use of oil emulsion muds, this was an industry-wide problem. Today the problem is not as critical since much research has been done through the cooperative efforts of oil and rubber companies. The benefits of oil emulsion muds are becoming well known. The most commonly used oils for emulsion muds are either crude or diesel oil. Since diesel oil is more difficult to emulsify, a larger amount of emulsifying agent is required. With this addition, many drilling companies using diesel oil have had great difficulty in maintaining pump valve inserts, rotary hoses and other rubber equipment.

This problem can be rectified by using oil-resistant rubber products or by specifying oils from bulk agent having a low aromatic content.

The reason many drilling contractors are not experiencing this trouble is because the cheap grade of diesel fuel commonly used has a low aromatic content.

As a safety precaution specify diesel oil with an aniline point of 150 degrees or above, to your diesel oil supplier. (The aniline point of a fuel is the temperature in degrees Fahrenheit at which oil will mix with a chemical called aniline. Aniline is a measure of the aromatic content of an oil.) High aniline point would indicate a low aromatic content. This means oil with an aniline point of less than 150 degrees should not be used or else detrimental effects to the rubber parts of the pump may be expected.

Standardization of drill collars . . .

Q. *Why is there such a wide divergence in the pin and boxes of drill collars in the U. S.?*

A. You will find, as a general rule, that in areas where long strings of drill collars are run, say 20 to 30 to 50 drill collars in a string—the tool joints will be about one-half size smaller than in areas where short strings of collars are used. This is also true in the harder rock country.

In Oklahoma, the Gulf Coast, North Texas, a six-inch drill collar would use either a 4½ H-90 joint, or a 4½ extra hole joint, or a 4½ full hole joint.

In the West Texas area on the same 6 to 6¼-inch drill collar, you would use a half size smaller, in other words, a 4-inch H-90 joint.

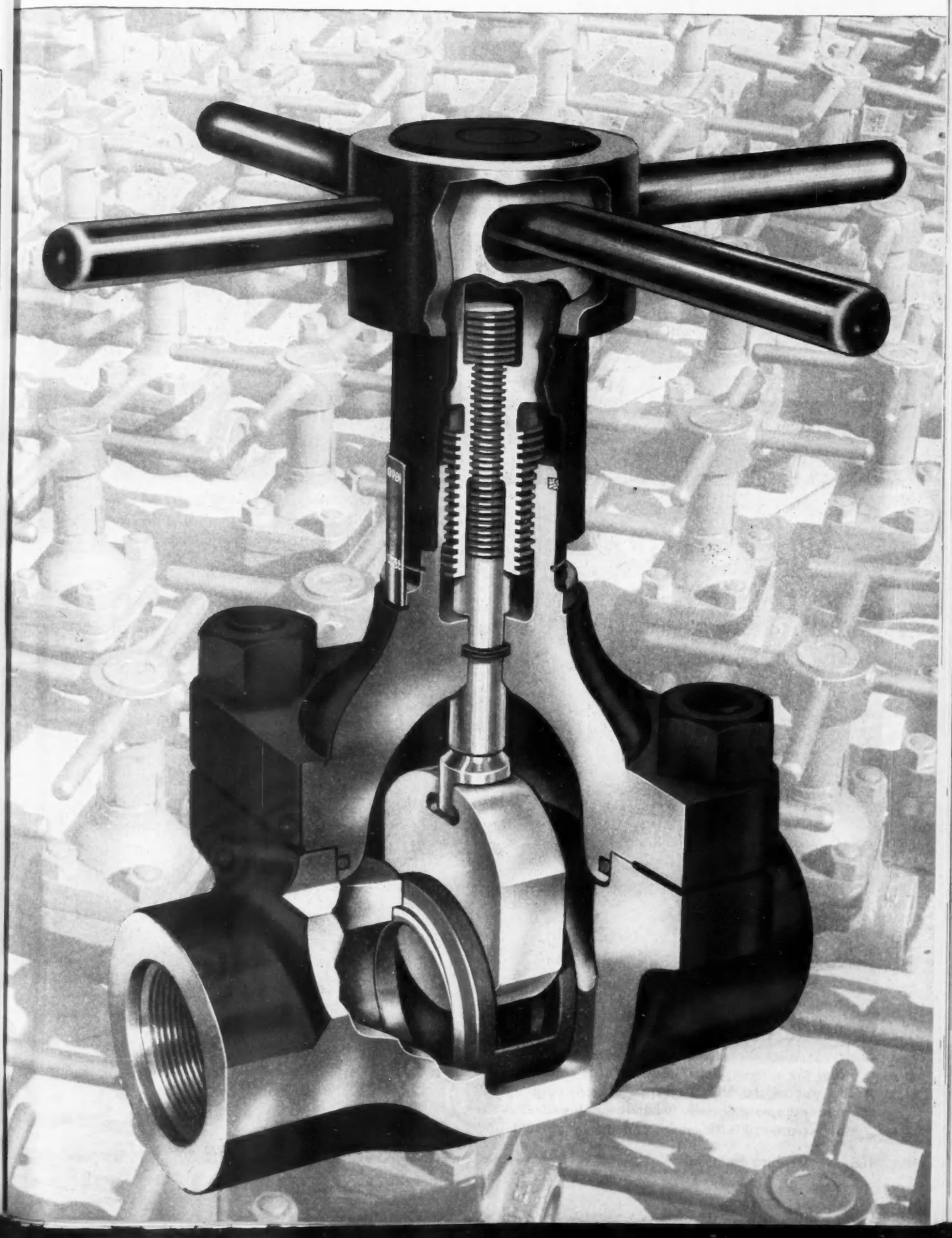
The reason is that in West Texas the condition of vibrating drill collars on hard rocks causes more box failures. In other areas of the country the tendency is to have more pin failures. By using the larger joints you get larger pins, and in the West Texas area more strength is desired in the boxes.

In California operators use very large pins, as a result they don't have much drill collar trouble, however, they do have pin failure. This hookup in West Texas area would be comparatively useless.

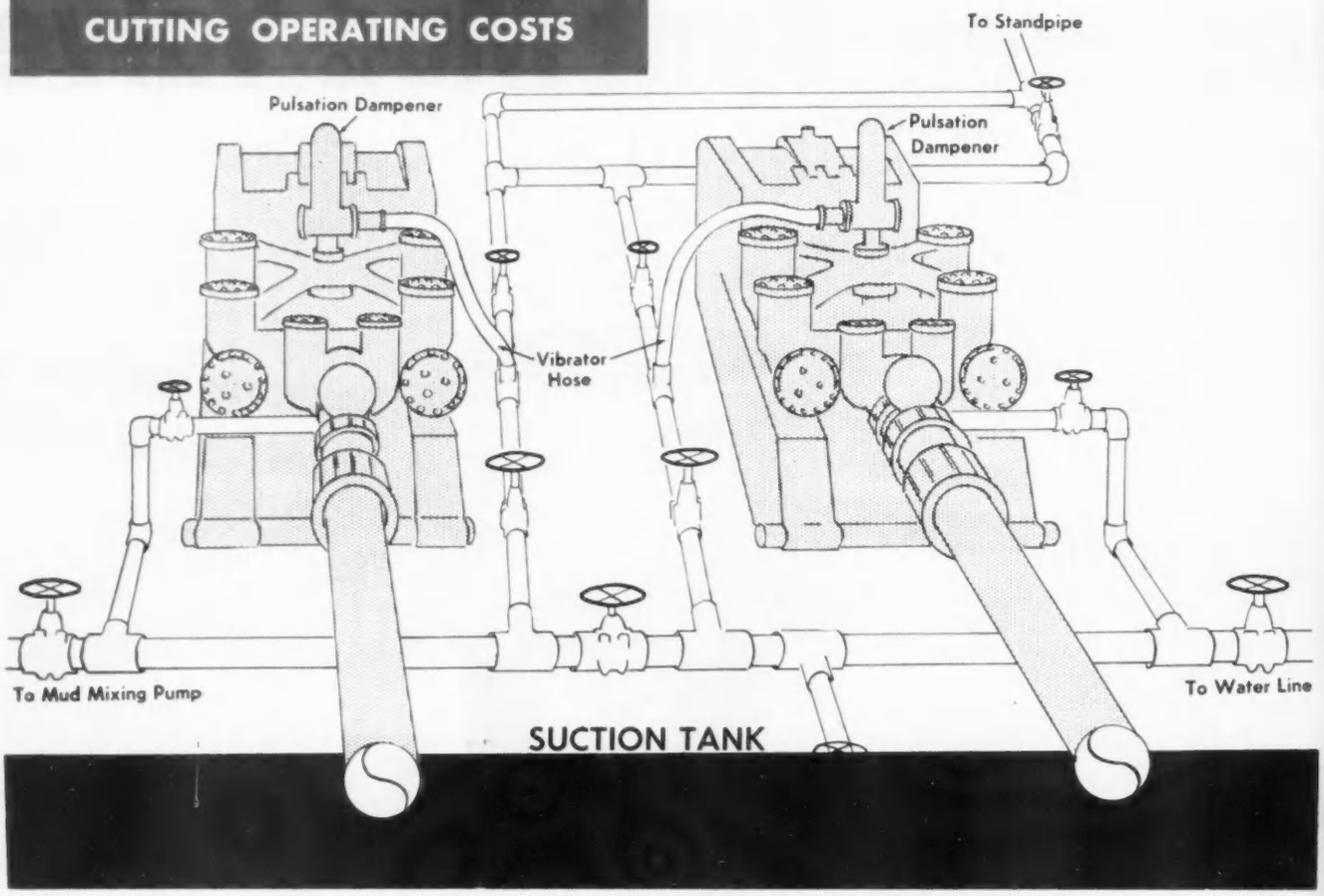
It is surprising to note that about 60 percent of the tool joints in the West Texas area are H-90 joints, whereas, in other areas this size would represent a very small percentage. The H-90 joint with the same amount of torque would tend to be a little tighter. This is due to an elastic deformation in the boxes—the flat thread causes the boxes to swell a little more giving them more elastic deformation. This is what holds it tight.

Continued on Page 166

Rockwell-Built Mud Valve



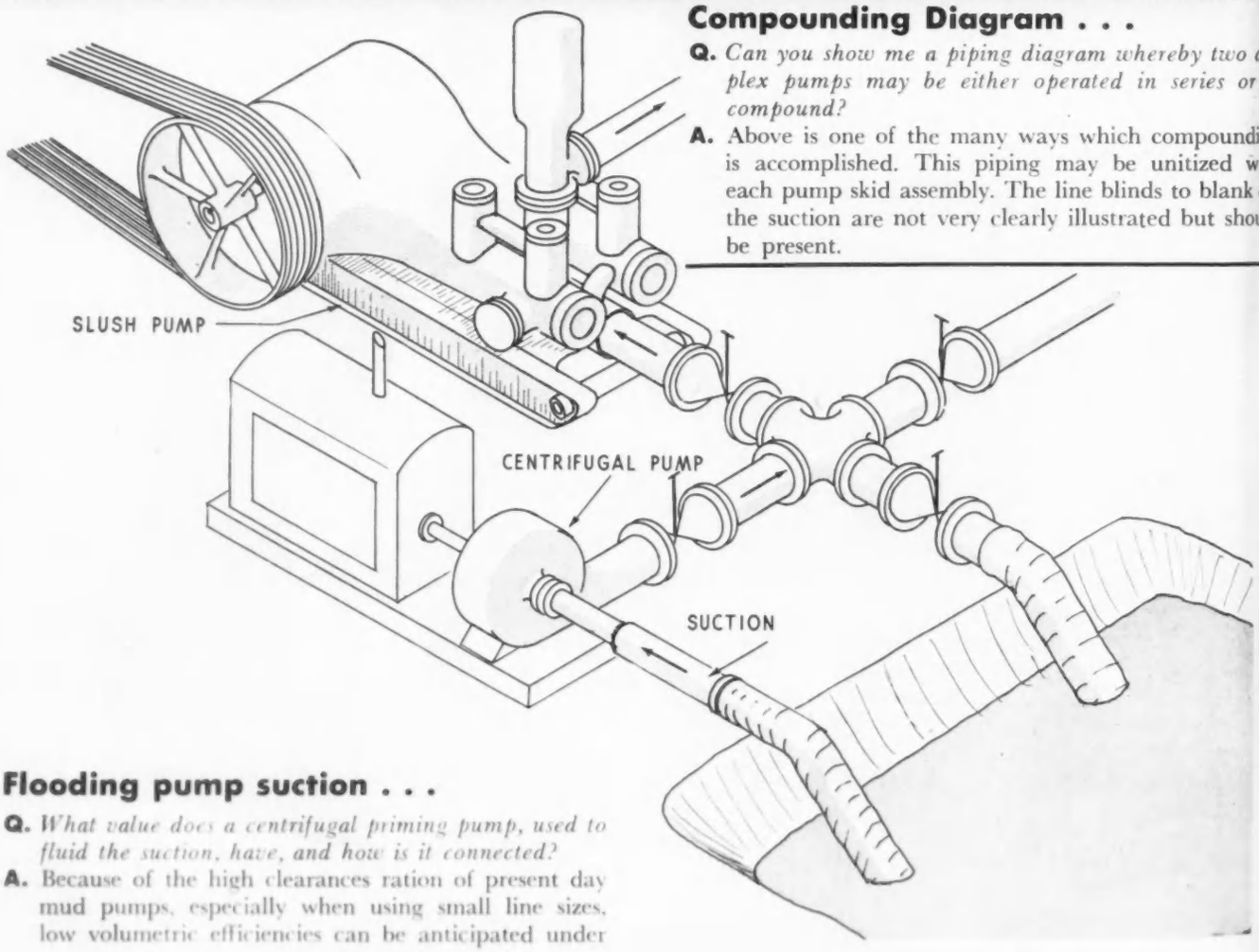
CUTTING OPERATING COSTS



Compounding Diagram . . .

Q. *Can you show me a piping diagram whereby two duplex pumps may be either operated in series or in compound?*

A. Above is one of the many ways which compounding is accomplished. This piping may be unitized with each pump skid assembly. The line blinds to blank off the suction are not very clearly illustrated but should be present.

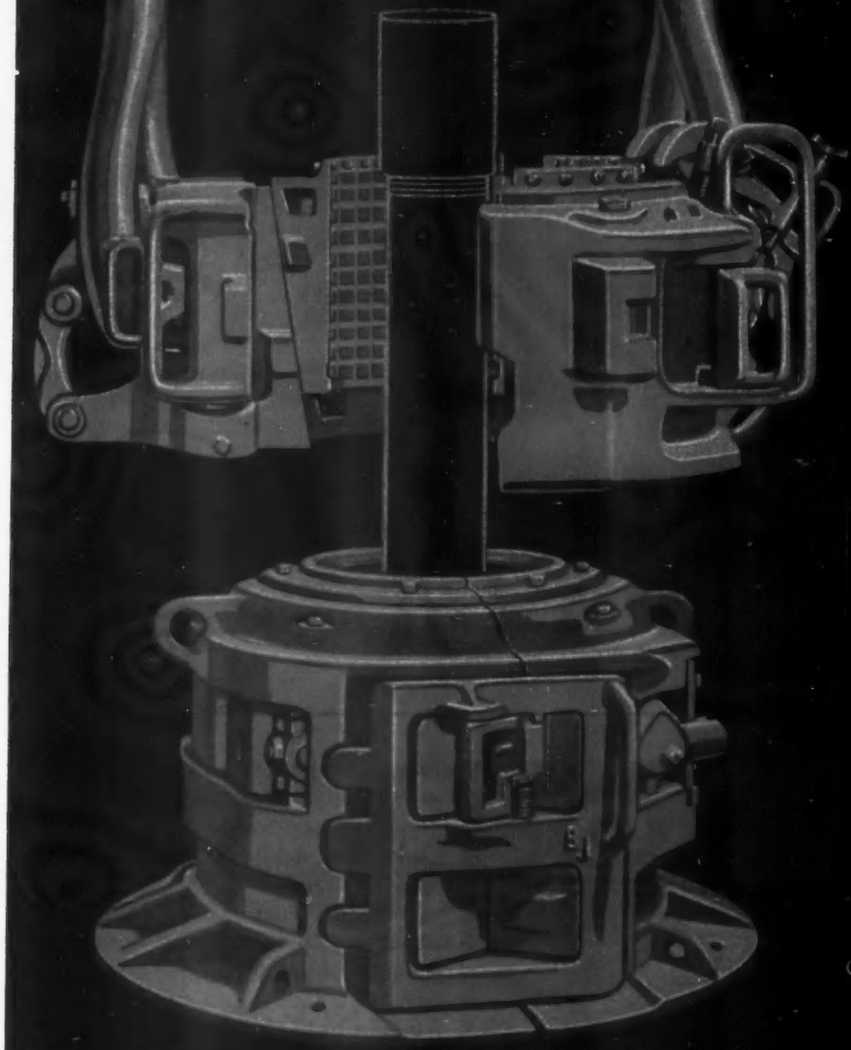


Flooding pump suction . . .

Q. *What value does a centrifugal priming pump, used to fluid the suction, have, and how is it connected?*

A. Because of the high clearances ration of present day mud pumps, especially when using small line sizes, low volumetric efficiencies can be anticipated under

run casing with confidence



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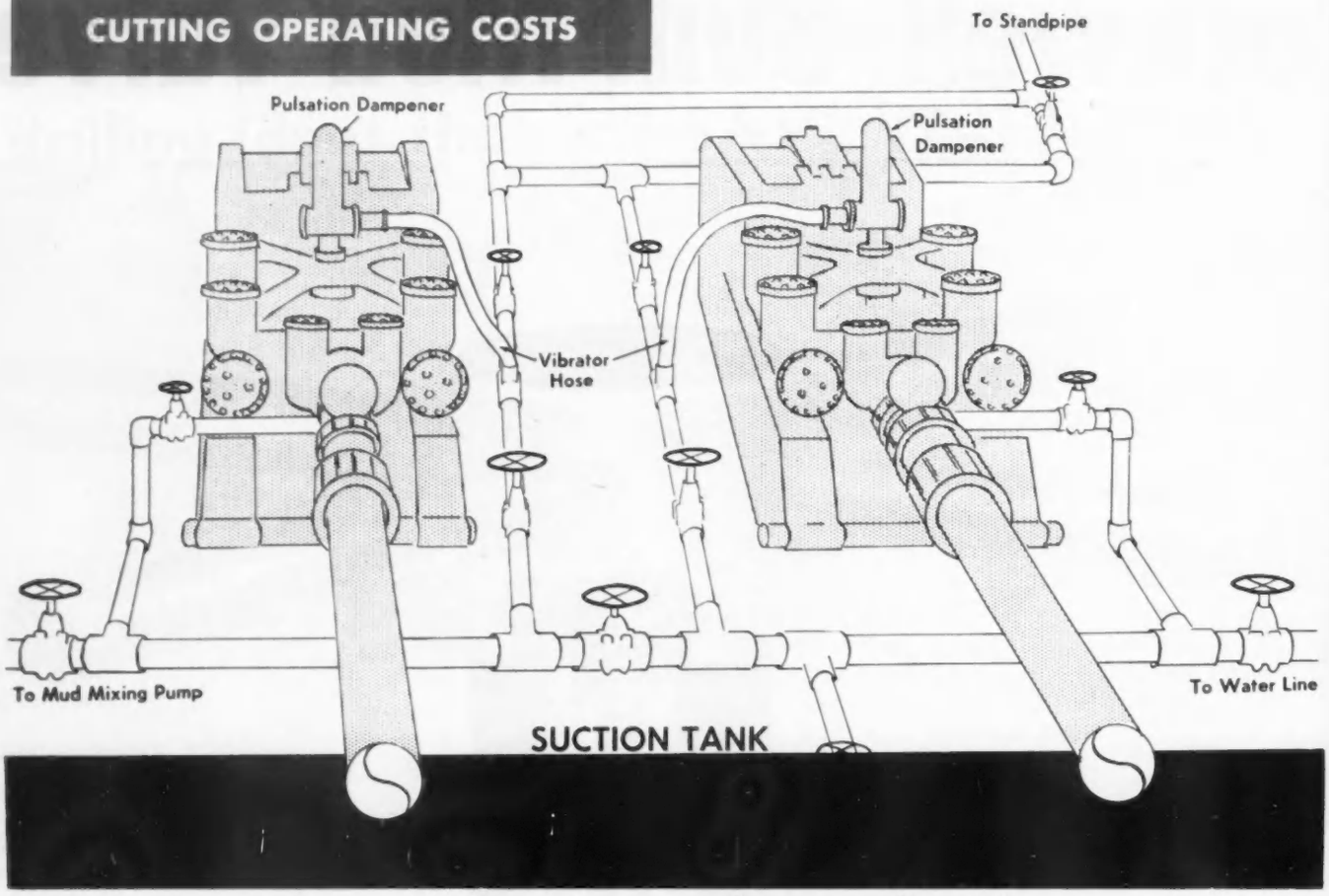

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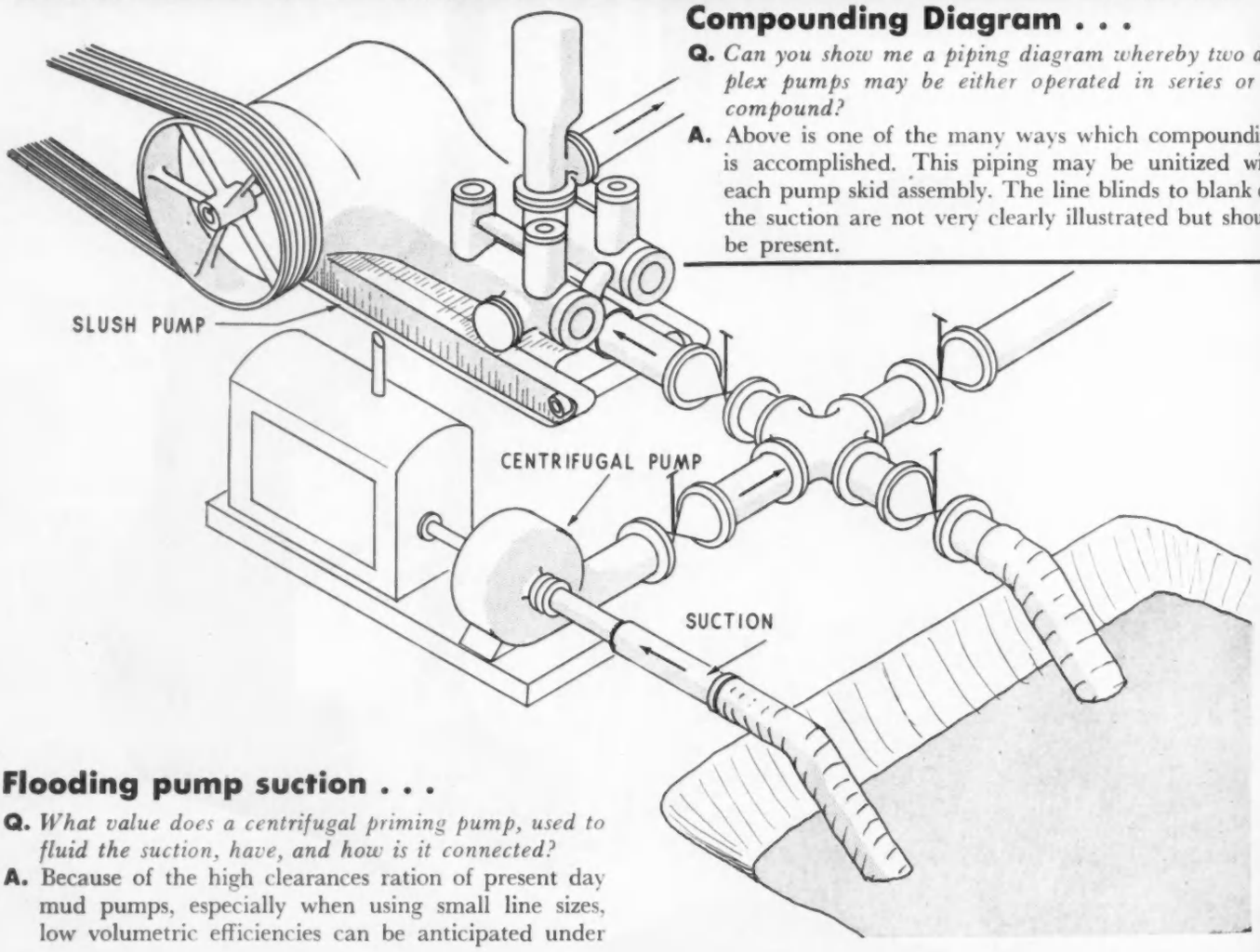


Flooding pump suction . . .

Q. *What value does a centrifugal priming pump, used to fluid the suction, have, and how is it connected?*

A. Because of the high clearances ration of present day mud pumps, especially when using small line sizes, low volumetric efficiencies can be anticipated under

certain conditions, such as using earthen pits, long suction lines, small diameter or cutting filled, suction lines.

Not only is fluid volume sacrificed, but also low volumetric efficiency results in unnecessary shock loads on the power end of slush pump. The latter is detrimental to equipment life.

The following figure shows one way of adapting a priming pump to the slush pump. It will be observed that the supercharging pump has a suction hose with an attached foot valve (not shown) placed in the suction pit.

Another method takes its power by a direct V-belt drive off the pump sleeve. The priming pump discharges into a four way "T" through which the mud can either prime the slush pump or can be passed to another point of service.

Cost of purchasing and installing centrifugal pump varies from $750 to $1500. These pumps are designed to operate at a discharge pressure of 20 psi to 40 psi and at a capacity equal to that of maximum slush pump capacity.

Some drilling contractors maintain that savings are made on the fluid end parts. This type of low investment pump can often replace a high cost positive displacement pump in the following uses other than supercharging; use for mixing mud, agitating the pits, jetting pits, and cellars.

Electrical equipment storage . . .

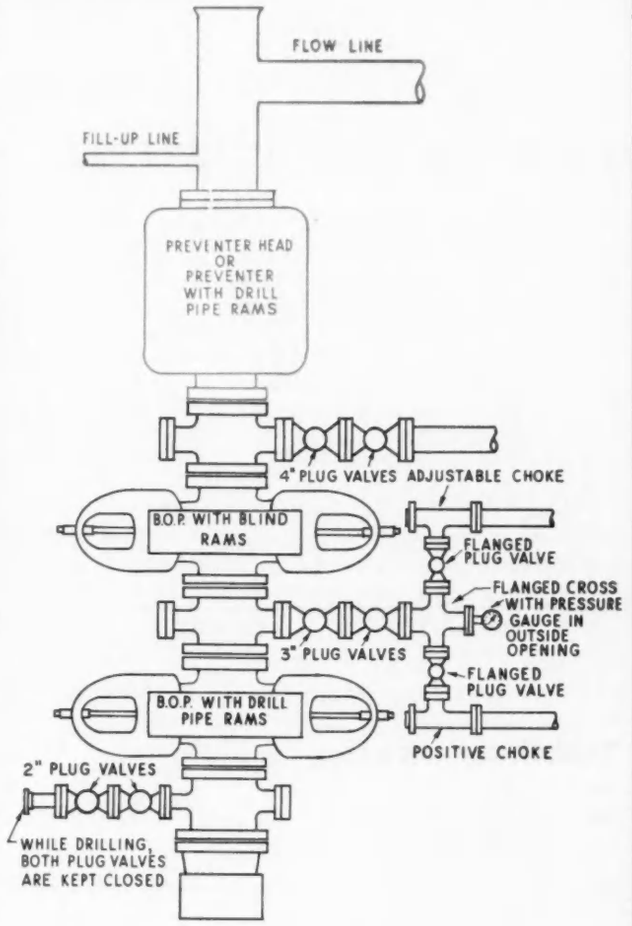
Q. *One drilling contractor in the Gulf Coast asked, "How can I store my electrical equipment on drilling rigs?"*

A. Drilling contractors who must stack their rigs during periods of slack drilling have found that it takes less money to reactivate their rig equipment if they borrow some ideas from the U. S. Navy. When storing electric motor and electric generating plants, the best practice to follow for preservative measures would be:

- Lift all brushes off the armature.
- Use heavy waxed paper or heavy water repelling paper and masking tape to wrap around the copper on the armature.
- Paint all rubber insulation and wiring with a rubber preservative.
- Seal off all brush openings to the motor with heavy waxed paper and masking tape.

When it is time for reactivation of equipment, remove all paper and tape, lower brushes, and if possible use some method of heating to drive off all excess moisture from the motor. If this is not possible, it would be wise to use a very fine sandpaper and carbon tetrachloride. The results will be a reduction in the replacement parts necessary for reactivation of equipment.

CUTTING OPERATING COSTS


FLOW LINE
FILL-UP LINE
PREVENTER HEAD OR PREVENTER WITH DRILL PIPE RAMS
4" PLUG VALVES
ADJUSTABLE CHOKE
B.O.P. WITH BLIND RAMS
FLANGED PLUG VALVE
FLANGED CROSS WITH PRESSURE GAUGE IN OUTSIDE OPENING
3" PLUG VALVES
FLANGED PLUG VALVE
B.O.P. WITH DRILL PIPE RAMS
POSITIVE CHOKE
2" PLUG VALVES
WHILE DRILLING, BOTH PLUG VALVES ARE KEPT CLOSED

SUGGESTED BLOW OUT PREVENTER HOOKUP

Blowout protection . . .

Q. *Will you show a diagram of a recommended blowout preventer hookup, using two and three preventers?*

A. The blowout preventer hookup shown here has been adopted by some major companies as being adequate protection for most abnormal pressures now known. The black portion below is recommended for a two-preventer hookup, while the third preventer is shown in color at the top.

Welding . . .

Q. *What can an oil field welder do to prevent fires when cutting oily steel plates?*

A. Spread a thin layer of dry chemicals over the area which you are cutting, and the flames will be extinguished before they get a good start. This is a common practice in many other industries.

Continued on Page 170

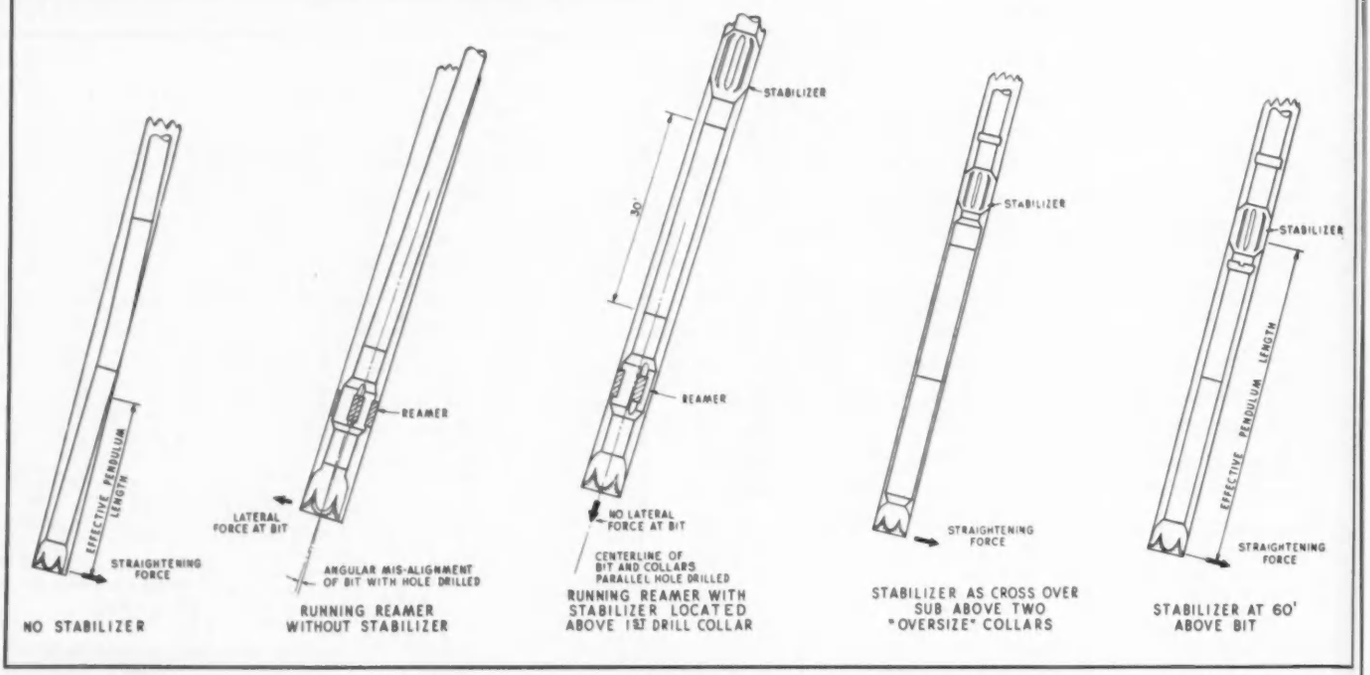


FIGURE 1 FIGURE 2 FIGURE 3 FIGURE 4 FIGURE 5

Stabilizer spacing . . .

Q. *Where should stabilizers be used in the drill collar string to prevent crooked holes?*

A. It is generally agreed that crooked holes develop due to the bending of the unsupported drill collar string. This is shown in Figure 1.

Hole deviation is also believed to be caused, in many instances, by running a reamer above the bit as shown in Figure 2. It can be pointed out that reamers are often used above the bit to purposely act as a fulcrum to gain angles in directional drilling practices.

Stabilizers have been used with reamers as illustrated in Figure 3 to prevent hole deviation with satisfactory results. Where a reamer is not used in this arrangement, an additional stabilizer should be substituted for the reamer. The stabilizer is usually placed 30 feet above the reamer.

One of the recent and most popular methods of reducing crooked hole problems has been the use of oversize drill collars and stabilizers in the West Texas area. See Figure 4.

Once the hole has gone crooked, an effective method for straightening the hole has been to locate a stabilizer about 60 feet above the bit as illustrated in Figure 5.

Additional work is currently being done to determine if the stabilizer should be placed closer together to effect a straighter hole condition. Lubinski and Woods are continuing their studies.

Washover pipe . . .

Q. *What wash pipe sizes are most common in the oil industry today?*

A. WORLD OIL asked several fishing tool companies to provide this information. We are indebted to them for the table shown here. As a general practice, in soft drilling areas of Gulf Coast, 1 inch clearances are recommended between the outside diameter of the washpipe and the hole size; where as, in West Texas and similar type drilling, one-half inch clearance on diameter is recommended. However, it is realized that in some instances, closer clearances have been used with success. Fishing tool companies carry a supply of washpipe suitable to the area in which they operate.

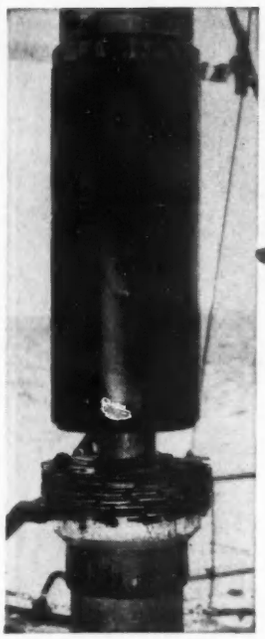
WASHOVER PIPE

Outside Diameter Wash Pipe	Inside Diameter of Wash Pipe	Maximum Drill Collar Size	Minimum Hole Size
11¾"	10 13/16"	10½"	12¼"
10¾"	10"	9¾"	12"
9⅝"	8 11/16"	8½"	10⅝"
9⅝"	8¾"	8½"	10⅝"
9"	8 5/16"	8"	9⅝"
8⅝"	7 13/16"	7½"	9⅝"
8⅝"	7⅝"	7½"	8¾"
8¼"	7¼"	7"	8¾"
7⅝"	6¾"	6⅝"	8⅜"
7⅝"	6⅞"	6⅝"	7⅞"
7⅝"	7⅛"	7"	7⅞"
7⅜"	6 11/16"	6½"	7⅞"
7"	6⅜"	6¼"	7⅝"
7"	6 5/16"	6"	7⅜"
6⅝"	5⅞"	5¾"	7⅜"
6⅝"	5⅞"	5¾"	7⅜"
6⅜"	5 11/16"	5½"	6¾"
6"	5⅜"	5¼"	6¼"
6"	5⅜"	5¼"	6⅜"
5¾"	5 9/32"	5"	6"
5½"	4⅞"	4¾"	5¾"
4½"	3 27/32"	3¾"	4¾"
4"	3¼"	3⅛"	4¼"

Continued on Page 180

NOW - only JOHNSTON provides this new, field-proven testing method!

with BOB TAIL PACKER and HYDRAULIC TESTER



THIS . . . Actual photo of the new Bob Tail Packer coming out of the hole without any extrusion or flow of the rubber packing element!

NOT THIS . . . Typical example of the extrusion that occurs on conventional packers — now practically impossible with the new Bob Tail Packer!

BOB TAIL PACKER

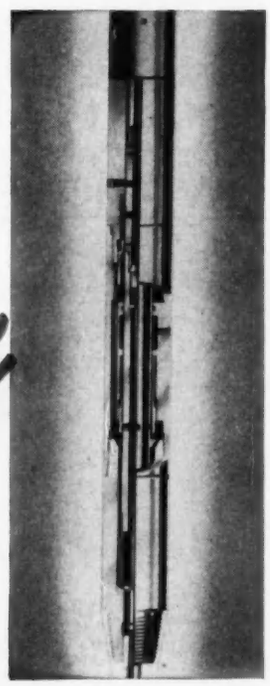
Absolutely Prevents Extrusion! You get the tightest seal it's possible to produce . . . a **perfect** seal. With the Bob Tail Packer there's **no** extrusion, **no** flow of the rubber packing element! Here's why the new Bob Tail Packer makes such a big difference:

★ **Pack-Off Is Up To 30% More Effective!** Metal petal cups at base of packer hold the rubber in the pack-off zone! Rubber **can't** flow or extrude down the lower packer assembly!

★ **Up to 3 Times MORE Clearance** when going in the hole. The Bob Tail utilizes entire volume of rubber in the pack-off zone. Loses none to extrusion—so a much smaller diameter is effectively used.

★ **Removes Easily From Packer Seat** after the test is completed, rubber is intact, thanks to the special design.

Type B Hydraulic Tester prevents shock to formation, pipe and instruments and needs **less** water cushion!



TYPE B HYDRAULIC TESTER

Prevents Shock To Test Zone by releasing pressure **slowly** below the packer! The Type B Hydraulic Tester opens in stages during 2½ to 4 minutes . . . allows spudding through tight spots you may find in open or uncased hole!

Positive Operation for Positive Interpretation! The compact, self-contained Johnston Hydraulic Tester opens by applying drill pipe weight, closes by removing weight! Functions smoothly **every** time—reduces plugging and damage to wall of hole.

See The Difference this super-accurate testing team can make for you! Remember, it's always Johnston **first**—in speedy service, in new developments for **accurate** testing!

JOHNSTON TESTERS

first in drill stem testing

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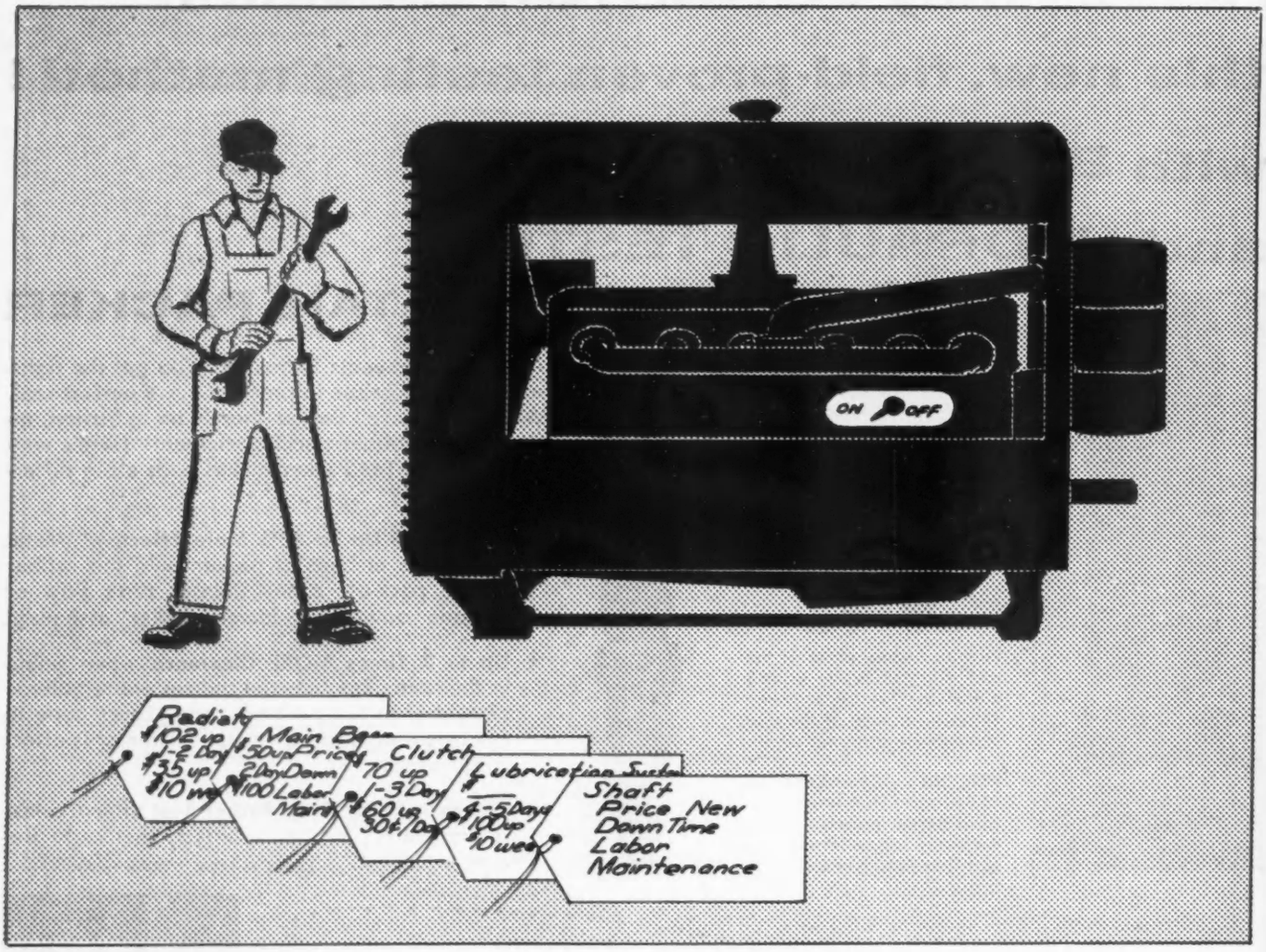
FORMATION AND CASING TESTING — JOHNSTON



SAVE MONEY with . . .

Proper Drilling Engine Maintenance

Here's a check list that can add years of service to gas engines.

By ANTHONY GIBBON, WORLD OIL Staff

DESPITE CLAIMS that oil field gas engines, whether on drilling rigs or producing leases, will run without attention, the smart operator takes no chances and applies plenty of preventive maintenance know-how to keep his engine running smoothly, efficiently and economically.

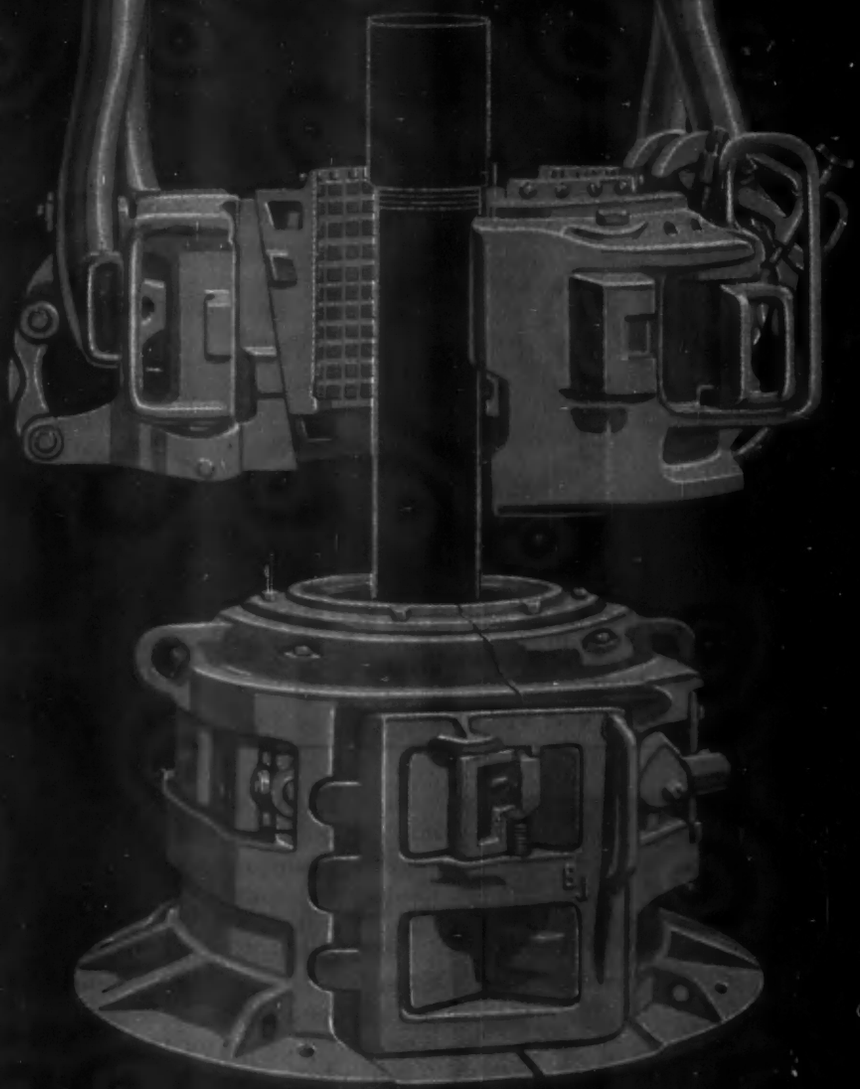
The multiple cylinder, internal combustion engine operating on natural gas is an economical prime mover, providing it is given some attention and a fair chance to perform. After all, nothing mechanical has been invented that will run indefinitely without attention.

The principal parts of a gas engine which need periodic checking are:

- Cooling system
- Air cleaner
- Safety devices
- Clutch power take-off
- Magneto
- Spark plugs
- Lubrication system

Continued on Page 174

run casing with confidence



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MAINTAINING EQUIPMENT . . . check the cooling system

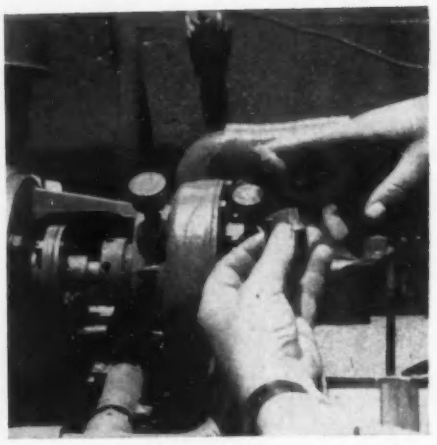
All oil field units are designed with ample cooling for an atmospheric temperature of 110° F. when operated at recommended loads and speeds. The cooling system includes the water pump, radiator, thermostat, fan, belt, and the water used in the system.

Water treatment is important and growing more so each day. Drilling contractors need to obtain continuous service and in areas of hard water and mineral deposits, cooling system will be a constant source of trouble. Also, it will not take long for the deposits to coat the cooling system sufficiently that the engine cannot operate at all. Water filter, filter element, and installation cost—$21 to $64.

Electrolytic action between two active metals in contact with the cooling water will cause excessive corrosion destroying such parts as the water pump, tubes and baffles.

Sludge is put into the cooling system by the engine in the form of grease, oil, and combustion products. Dangerous chemical residues can be built up also by cleaning compounds and antifreezes remaining in the system. Rust is also a reason for cooling system failure. Rust begins when leaking hose connections, pipe fittings or water seals allow air to enter the cooling system. Rust will form plugs which block cooling passages and cause an overheating of the engine. Applying preventive maintenance to a cooling water system includes more than in frequent checking. It means knowing what to check and what to do when it should be done.

CHECK FAN BELT. At beginning of each tour, the driller should have a crewman test belt for slippage and wear.



CHECK WATER PUMP. Use only special waterproof grease. Other grease might be dissolved and washed away by water in pump. Turn the cup down a half turn every 24 hours.

Water pumps do not require any service lubrication, but do require checks for corrosion, cracks, or bearing wear. Failure to treat water correctly or check pump parts will cause pump to wear out sooner than necessary. Cost—$39 to $200.

Radiator should be checked frequently and cleaned after 500 hours of operation. The operator should make certain there are no deposits plugging the radiator and engine jackets. Water treatment is important to the service a radiator can give. Failure of a radiator means downtime for the drilling contractor. Cost —$102 to $1600.

Thermostat should be examined for corrosion frequently, and replaced if excessively corroded. Cost runs from $6 to $43.

Fan and belt should be inspected regularly to make sure no wear or slipping is present, and replaced if not operating correctly. Belt cost runs from $2 to $13. Fans cost from $1.50 to $90.

Check air cleaner . . .

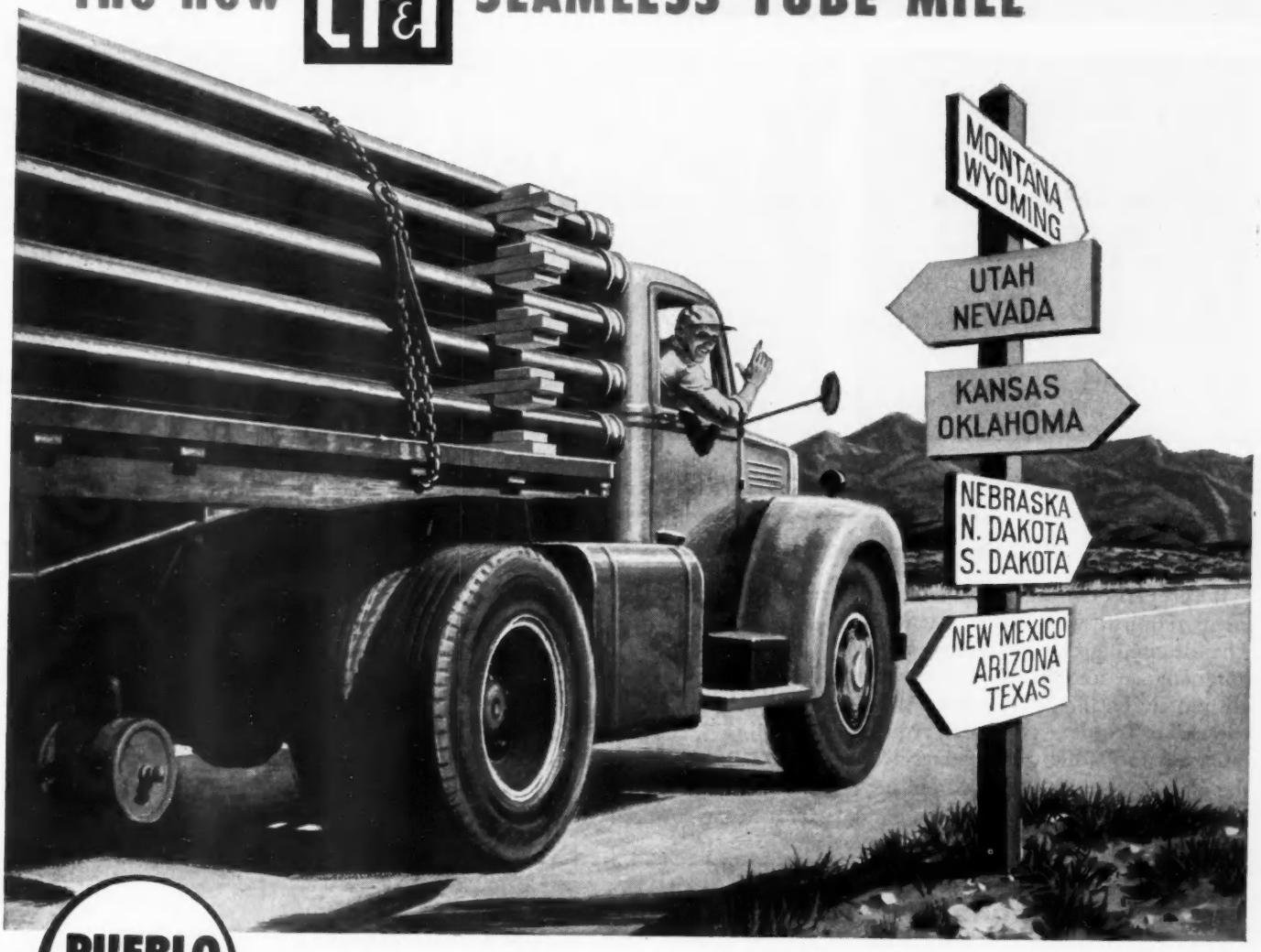
Oil country is dusty terrain, and an air cleaner is a must for engine operation. It takes only eight ounces of dirt to cause enough wear in an engine to necessitate an entire overhaul. All hose connections must be checked frequently to make certain they are air tight. The oil bath must be changed frequently, otherwise it will become ineffective. Cost of an air cleaner runs from $16 to $105.

Check safety devices . . .

An oil field engine should be equipped with "cut-outs" that will shut the engine down if the lubricating oil pressure is low or if the jacket water temperature is high. If these devices are in poor operating condition costly repairs and shutdowns may result. They should be checked carefully and all connections checked for corrosion and breaks. After an engine has been shut down by the automatic operation of a safety device it should not be started up again until the condition which caused the stoppage is remedied. Too often operators depend entirely on the safety devices but do not spend the two hours per month necessary for maintenance and testing. Costs of safety devices range from $20 to $26. Their failure can make replacement costs reach excessive amounts. *Continued on Page 176*

CHANGE OIL frequently in air cleaner. A clean air filter will prevent unnecessary ring jobs.

the new CF&I SEAMLESS TUBE MILL



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AT THE CROSSROADS

of the western oil country

Located at Pueblo, Colorado, the CF&I Seamless Tube Mill is ideally situated to provide prompt and efficient service to the oil and gas industries of the Rocky Mountain and Southwest areas.

Newest mill of its kind and first to be built west of the Mississippi, it incorporates the most modern fabricating facilities and advanced production and inspection techniques.

Combined with supervised control from blast furnace to finished product, these up-to-the-minute facilities assure you of seamless casing and tubing of the highest quality.

CF&I Seamless Oil Country Casing and Tubing meet API STD 5A specification and are available in sizes from 2⅜" O.D. through 9⅝" O.D.

CF&I TUBULAR PRODUCTS

THE COLORADO FUEL AND IRON CORPORATION CFI

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MAINTAINING EQUIPMENT . . . check the timing

. . . on the magneto

. . . on the distributor

. . . on the flywheel

Check the clutch power take-off . . .

If properly installed this equipment requires very little attention. The original grease is sealed in on some engines and should last for the normal clutch life. The clutch throwout collar requires grease at regular intervals and while this is being done the clutch should be checked for necessary adjustment. The clutch should never be permitted to slip under load.

Friction clutch must have careful alignment. Otherwise it is possible to ruin the pilot bearing, drive gear, and friction plate. Cost $70 to $1500.

Hydraulic clutch oil should be changed according to recommendations. Make sure only leak proof connections are in use. Make yearly check or replacement of bearings and fluid seals.

Air clutch parallel and angular misalignment cannot exceed 0.015 inch. Misalignment of clutch can result in destruction of a crankshaft with eventual repair for large engine reaching $3500. Cost of air clutch $1800.

Check the magneto . . .

Most oil field engines are equipped with a magneto ignition system and here again preventive maintenance spells the difference between continuous operation and costly shutdowns. Breaker points in a magneto should be checked for gap every six months. Most magnetos require a drop of oil and a little grease about every 90 days. The impulse coupling should be washed out and greased if the engine runs continuously, because dust accumulates and causes impulse to stick. The impulse coupling on engines started every day will keep themselves fairly clean. Dirt accumulates when the impulse is not working. Where a spare magneto is being carried the points should be closed tight before it is put away, because open points in time will corrode.

Check spark plugs . . .

The most common trouble with spark plugs is widening of the gap. This may not only cause a cylinder to misfire but it also puts a high voltage strain on the magneto and will cause break down of the rotor coil. The spark plugs should be checked and the gaps set at the correct distance at least every 45 days. When spark plugs are replaced they should not be screwed in too tight as this tends to change the gap.

REMOVE AND INSPECT plugs at least once every 45 days. Points should be set at 15/1000 to 20/1000 inch. Natural gas burns points off rapidly. As gap widens, it increases load on magneto.

Continued on Page 178

support your decision WITH THE BEST in drill stem testing

HALLIBURTON'S HYDRO-SPRING TEST

The wildcat shows its spots when the testing string is back on the walk. It's much easier to decide correctly with Halliburton's Hydro-Spring Test... the most accurate, modern, and complete formation test available.

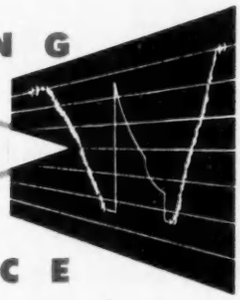
IN FIRST PLACE IT'S HALLIBURTON ALL THE WAY...

- ____ ***Hydro-Spring Tester*** **is First in number of perfect runs.**
- ____ ***Bourdon Tube Pressure Recording Device*** **is First in more accurate pressure recording.**
- ____ ***Expanding Shoe Packer*** **is First for instant release intact.**
- ____ ***211 Camps*** **are First in availability.**
- ____ ***Research*** **makes Halliburton First with practical improvements.**
- ____ ***2-Million-Job Experience*** **makes Halliburton First in field know-how.**

Make the swing to Hydro-Spring! When you make your decision, be sure you get the best in drill stem testing... Halliburton's Hydro-Spring Test. For minutes-away service, call your local or district Halliburton office. Or contact Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

Hydro-Spring Tester—Patent Applied For

TESTING **HALLIBURTON** SERVICE



"HALLIBURTON'S BEST FOR YOUR DRILL STEM TEST"

MAINTAINING EQUIPMENT . . . check lubrication system

Care should be taken in using only the proper oil and grease recommended by the manufacturer who will supply the correct S.A.E. number for both. The correct oil level should be always maintained in the engine and the oil should be changed when necessary. Oil pan and oil pump screen should be regularly inspected. If dry gas is used, use upper valve lubricant.

Component parts of the lubricating system are the oil pump, oil cooler, oil filter, oil temperature regulator, and the oil used in the system.

To perform correctly, a lubricant must do three things. It must provide a lubricating film so that moving parts will not come in contact with metal surfaces. It must cool, carry away excess engine heat. It must carry away destructive material such as dust, metal particles put into the engine.

An engine must have clean oil. After a certain running period, ordinary engine operation will make oil unfit for the purposes for which it was designed. By its very operation, an engine puts dust, carbon, water, fuel, and metal particles into the oil. Lubricants can perform an excellent service towards removing these contaminants for only certain lengths of time. When used too long, however, the lubricants become carriers of destructive particles, and cause excessive wear on vital, internal parts of the engine. An engine will use oil, and it will contaminate oil. Failure to recognize this fact may result in destruction of vital engine parts and necessitate a complete engine overhaul.

CHECK OIL FILTER. Change oil filter sock each time crankcase oil is changed or every 100 hours, whichever is sooner. Sock can be loosened by running knife around it. Water frequently collects in sump. Drain it when oil is changed.

Because of the rapid oxidation that oil undergoes at high temperature, it is important that the oil temperature be controlled. When the oil temperature rises too far above normal operating temperature, the acid content of the oil is increased causing accelerated corrosion.

Three major causes of lubricating system resulting in a shutdown are:

- Circulation of dirty oil
- Sludging condition
- Excessive temperatures

Cost of weekly servicing of the lubricating system is less than $10 per week.

Failing to maintain proper lubricants and proper operation conditions will eventually cost from $4000 to $6000. Downtime could run at least 4 to 5 days.

Oil pump wearing parts are receiving constant lubrication, but contaminated oil will cause wear, and eventually failure. Cost—$24 to $215.

Oil cooler provides for proper operating temperature of lubricant. This should be checked frequently for leaks, and replaced if leaks cannot be stopped.

Lubricating oil filters. The type of lubricating oil filter selected is not important providing it has been engineered for the type engine on which it is installed and is approved by the engine manufacturer. The same applies to replacement filter elements. The filter element should be changed whenever the oil is changed and especially if the oil pan is flushed out. The lubricating oil filter will do its best job at oil temperatures of 160° to 180° F. It should be remembered that lubricating oil functions two ways: First, it lubricates; second, it absorbs and carries away heat from closely fitted parts. It is also true that the rate of oxidation of lubricating oil becomes more rapid as temperature increases. The ideal oil is just warm enough to pass freely through the filter element.

The oil field gas engine operator should realize that the few dollars saved by neglecting minor adjustments are not only wasted, but result in far greater loss because of costly overhauls due to lack of proper attention.

ACKNOWLEDGMENT

Information for this article was furnished by Buda Engine and Equipment Company, Tulsa.

—The End

SAVE MONEY . . . by making your crewmen cost conscious

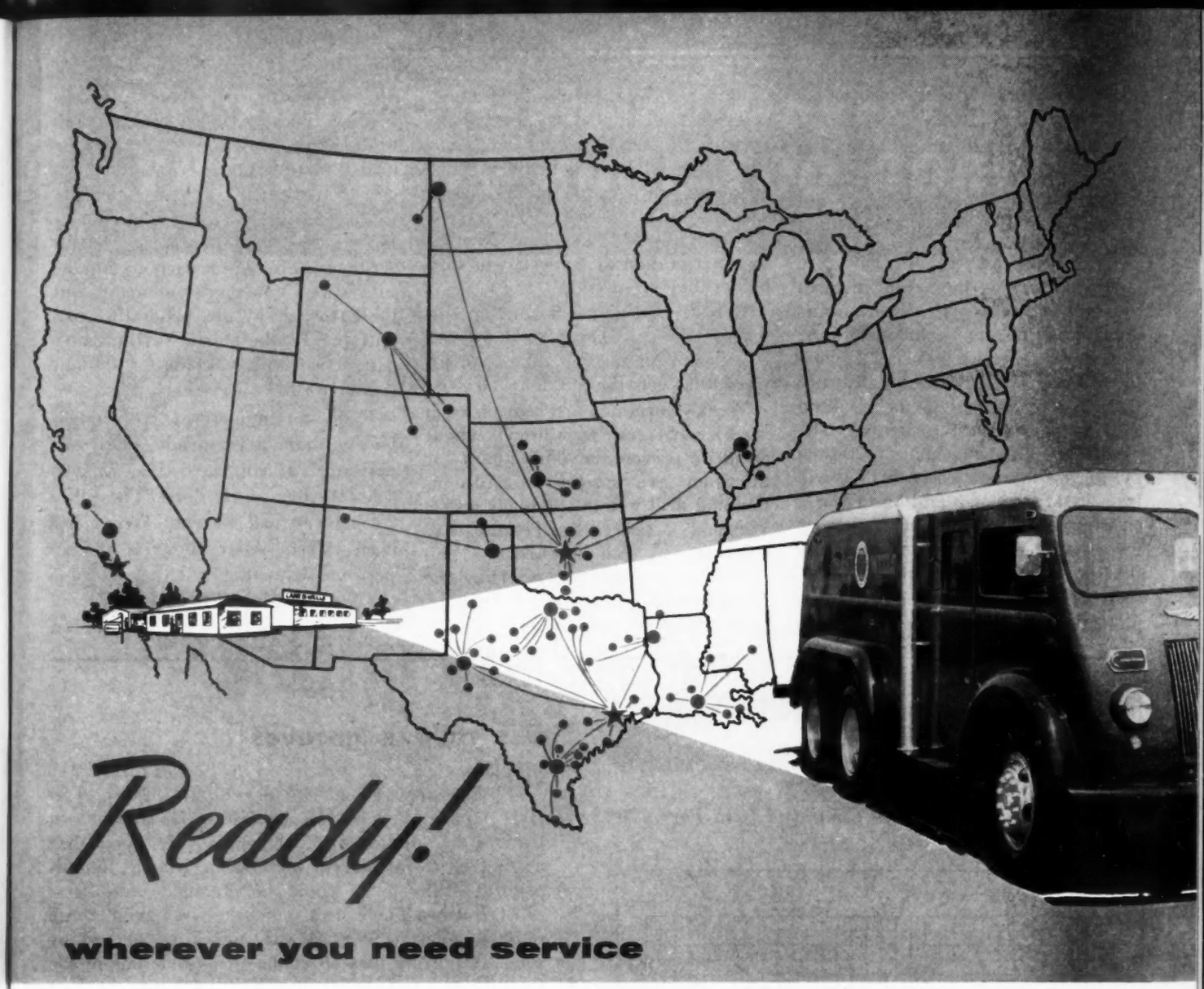
SOUTHEASTERN DRILLING COMPANY has inaugurated a cost reduction program which is saving money because every man on the rig floor is made aware of the cost of equipment. This "let the men know" attitude is keeping costs down. It has inspired competition among crews and toolpushers to save when they can and specify only that equipment that allows the company to get more for its contract dollar.

Each toolpusher gets a monthly report as to what his operating costs per operating day for the past month have been. To substantiate that, Southeastern attaches copies of vendor's invoices.

They have established about 30 expense codes that break costs into various subjects, i.e., engine costs, drawworks, pumps, welding, wire rope, hand tools, fuel, oil and grease, etc. At the end of each well and after all the bills are in, Southeastern gives an accurate operating cost by codes, to all the toolpushers.

It is surprising how the toolpushers compete to get their costs down so as to be No. 1 on the list. On the monthly reports the toolpusher reviews the invoices with his drillers and crewmen. This stimulates interest by all, as the costs of some of the items purchased daily are astounding, i.e.:

- A valve cover stud for 20-inch pump (1⅜ inches by 5¼ inches long)—$5.89 each.
- Gate packing rubber for 4-inch 6000-pound test mud valve—$14.57.



Lane-Wells 95 branches in the United States, Canada and Venezuela are so strategically located that you're assured fast, dependable perforating service in every active oil area. Tell your nearest branch when you want them, and they'll be there, right on the dot, with modern, powerful equipment to do your job the way it should be done. And the crew that comes with it knows how to do the job, too, not only because they're backed by the experience gained in more than two hundred thousand perforating jobs, but because they really know local conditions—*your* conditions and problems. All of this adds up to one thing: doing your perforating *right!*

Tomorrow's Tools - Today!

A LETTER WILL BRING FULL INFORMATION

LANE WELLS COMPANY

BETTER PERFORATING

General Offices, Export Office and Plant • 5610 So. Soto St. • Los Angeles 58, Californi

Los Angeles • Houston • Oklahoma City • Lane-Wells Canadian Co. in Canada • Petro-Tech Service Co. in Venezuel

- Stem for a 2-inch 1000-pound shear relief valve—$22.21.
- Rubber roller for a wire line guide—$25.
- Air clutch element—$560.
- Tong dies—$1.20 each.
- Lube oil—75 cents per gal.

When checking the actual invoices the crew members see where some items such as unions and drill pipe wipers vary greatly in price. Henceforth, qualified purchasers will order the union or wiper they know will do the job and is least expensive. The pusher, by knowing that a 20-inch pump stuffing box costs $93.77, will have it turned down and bushed at a cost of $20 rather than buying a new one when it is worn. When he knows that a tell-tale liner packing rubber costs $4.67 each (four needed for a pump) he will buy only four at a time rather than the usual "gimme a dozen." This applies to all gaskets that have a manufacturers part number. They all know when you have adequate storage for eight gaskets and have 12, the extra four have a good chance of being spoiled either by deterioration or being cut or torn before they are needed.

It is stressed that it is not the toolpusher who can keep costs down. It's every man on the job taking an interest that gets the job done.

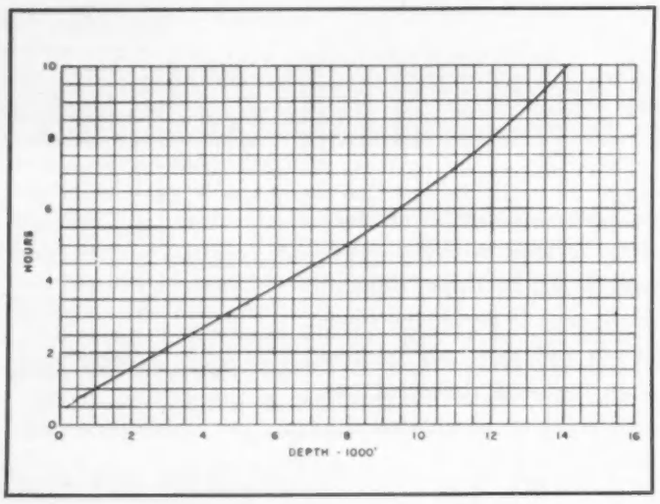
Weekly meetings are held on each rig by each crew. It is usually about accident prevention. The topics for discussion are mailed to each individual driller from the home office. We had a series of meetings with subjects, i.e., How the Driller Can Reduce Costs; another on How the Motorman Can Reduce Costs, etc. Each crewman participated in these discussions and each wrote up a suggestion. These suggestions got back to the home office and were published in the monthly house organ which all crewmen read.

Operating men are encouraged to make suggestions for cost reduction. A bonus is offered for each acceptable suggestion. You don't get many, but those turned in are generally good and give us the benefit of the man's experience while working for another contractor.

Reduction in operating costs hinges on one main item: steady, interested personnel. If you have that, 75 percent of your job is done. The other 25 percent will be easy. What has been talked about above is the 25 percent—education. *Let them know the facts* and interested employes will do the rest. **—The End**

CUTTING OPERATING COSTS

Continued from Page 170



Trip time chart . . .

Q. *In order to evaluate our drilling operations, we are interested in obtaining a reliable chart for estimating the hours required to make a round trip at various depths. Is such information available?*

A. Here is a trip time chart based on field information taken from numerous rigs in West Texas compiled by Southwestern District of API West Texas Sub-Committee on Jet Bit Drilling. This chart can be used by drilling engineers in their economical analysis of drilling operation. A more accurate hoisting time can be constructed for each contractor's rig by making time motion study of rig operation.

Stress relieve grooves . . .

Q. *Why use stress relief grooves on drill collar threads?*

A. L. E. Trishman at the API meeting at Shreveport in 1952 reported tests on full size drill collar connections made by a major supply company. He cited that around 40 to 50 percent increase in fatigue strength of drill collar joints could be obtained with stress relief grooves. These stress relief grooves have become quite popular in West Texas, and it is believed by some authorities that all connections sometime in the future will incorporate some type of stress relief at the last engaged thread in the pin box. Stress relieved drill collar pin and box connections are accomplished by turning a relief groove adjacent to the pin shoulder and turning out the inside diameter of box end of the collar to the root of the last engaged thread, and reaming this back several inches.

Static electricity on V-belts . . .

Q. *What is a simple way to keep static electricity off of V-belts and flat belts?*

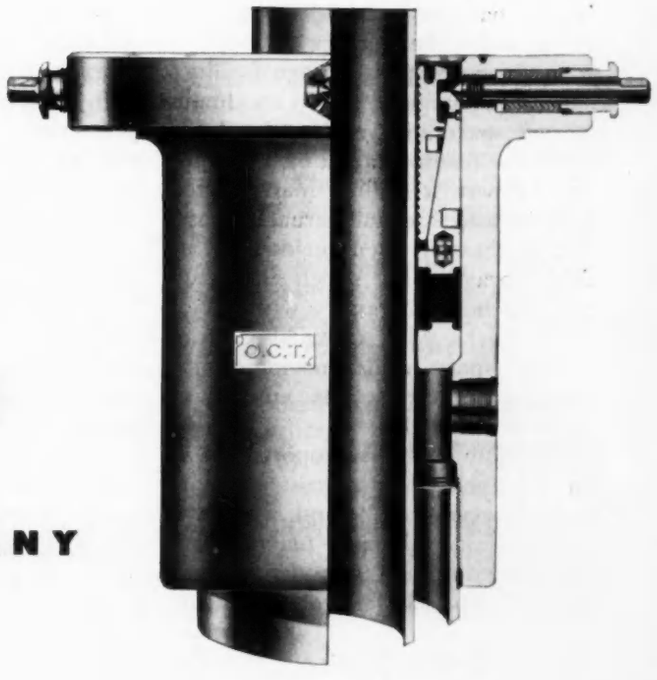
A. Some drilling contractors in the East and in the Rocky Mountain region are often troubled with this problem and it is possible to dissipate the static electricity by providing flexible metal strips which will rest on the moving belts to effectively dissipate this static condition. Since the static comes from friction of fibers of the belts rubbing on each other caused by the bending around the sheaves and air friction on the belts, it could be a troublesome item when a potential difference is built up with the belt acting as a condensor. The static electricity dissipates along the the belts, it could be a troublesome item when a poproblem in dry atmosphere. The metal strips act as a comb which acts as a conductor to convey the electric charges from each of the belts to a ground through a rod. **—The End**

On Your Off-Shore Operations, *THE BEST IS NONE TOO GOOD!*

O-C-T C-19 CASING HEADS give you greater safety and dependability

than any other hanger you can buy

O-C-T "C-19" Casing Heads are a natural for off-shore work. They are designed for maximum safety on both land *and* off-shore wells, saving you added costs for special equipment to give you the protection you need. The "C-19", designed for quick setting and positive sealing, gives extra protection against blowouts because the well is closed in around the casing and the seal applied automatically before preventers are unflanged. Both crews and rig are protected. Enough hours of valuable rig time are saved to more than pay for the cost of the head itself. Ask your O-C-T representative or write for information.



O·C·T

OIL CENTER TOOL COMPANY

Export Representatives: Sterling Areas — Le Grand, Sutcliff & Gell, Ltd., Rochester, Kent, England. Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston, Texas.

MONEY-SAVING IDEAS

Here are some important factors to be considered when solving . . .

Rig Storage Problems

THE PROBLEM of storing rig equipment and tools conveniently has long been one to which much thought has been given resulting in many variations.

Some basic limiting factors controlling storage planning are:

- The effect storage facilities have on moving and rigging-up costs.
- Convenience of storage to point of need.
- Degree of care required in storage and in handling from storage point to use point.
- Frequency of need for specialized equipment.
- "Stacked" rig storage requirements.
- Storage possibilities afforded by different class and type of rigs.
- Natural sequence by which equipment is stored.

Space problem. Storing rig equipment and supplies for moving is more often a space problem, and affects moving costs by increasing the number of loads to be handled. In order to minimize the number of loads, it is necessary to plan storage facilities sufficiently large to afford maximum storage space and yet meet legal size limits for transportation on the highway. Where a drilling mast is used with its associated sub-structure base, the sub base is often enclosed to afford storage space which eliminates the tool house necessary with standard derricks. Mud tanks also afford storage space while moving which will further reduce the number of loads to be handled.

Probably the most important way to minimize moving costs due to stored rig equipment and supplies is through maintaining a maximum of rig unitization and a prudently small stock of supplies. The volume of supplies to be stored at the rig will, of course, depend somewhat upon the distance to the vendors stock. With the use of two-way radio becoming more widespread, supplies and repair parts may be had in most active areas almost as quickly as they can be used.

Special handling. Certain items of rig equipment, such as the rig lighting system, rotary hose, weight indicator, etc., require special handling while in storage. Such items usually are stored in special containers or moving racks. Although this practice may increase moving costs slightly, the extra protection afforded the equipment is justified. Storing blowout preventers on racks to facilitate handling as well as to protect protruding studs and flanges is also a popular practice, as is the storage of flange bolts in an oil bath which eliminates corrosion and keeps the bolts ready for instant use.

A similar type of care is necessary for fishing tools, subs, drill collar connections, and drill pipe tool joints. All these items should be cleaned and lubricated while in storage and fitted with suitable protectors for thread protection while handling. Thus, it may be seen that care in storage will influence to some degree the type of storage facilities being planned even though moving costs may be adversely affected.

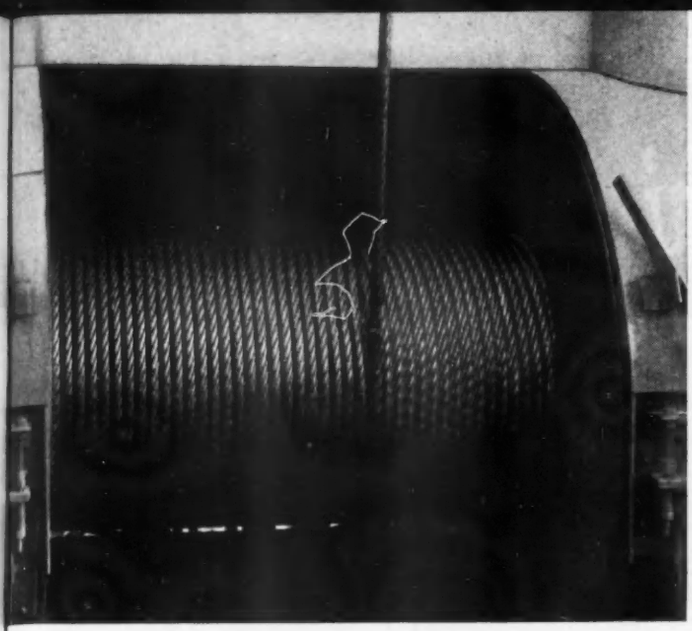
Certain pieces of rig equipment such as hand tools, safety devices, etc. which are used frequently should have storage space allocated which is convenient to the point of use. This requires portable storage racks and bins which may be located conveniently for derrick floor use. With derrick floor space limited, such storage space is sometimes provided in a house elevated to derrick floor level and used as a small equipment and supply storage space combined with the driller's report writing and record keeping space.

Theft protection. When drilling rigs become idle and are "stacked," stored rig equipment in addition to being protected from the weather must be protected against theft. Since locks may be broken, doors to storage houses are sometimes welded closed. Large items of equipment such as drill pipe, blowout preventer equipment, etc., must sometimes be moved to a protected area for storage. Although this type of care in storage is costly, it is all too often necessary in order to avoid the more costly theft. Drill pipe in storage is sometimes painted with a continuous paint band across the top row of pipe which if broken by the removal of pipe will call attention to a possible theft. Marking the equipment with an inconspicuous identification mark will aid in recovering stolen equipment.

Probably the most important element to be considered in planning the storage of rig equipment towards the end that costs will be held at a minimum is the sequence followed in placing equipment in storage. There is an old story about the roughneck who stored the pipe tongs in the tool house on top of the rig lighting system and weight indicator. In doing so, he not only violated all concepts on the care of equipment, but he placed on the bottom of the pile, equipment which will be needed before the tools on top may be used.

Reduces costs. Careful planning and supervision of rigging-down operations should result in the storage of the equipment in such a way that the equipment may be taken out of storage in the natural order it is to be placed in service. This practice has the effect of reducing rig-up time and costs, and justified additional rigging-down time which may result from more care used in storing the equipment.

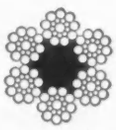
The proper storing of equipment and the careful planning of storage facilities is a continuous problem deserving the constant attention of the toolpusher and his supervisor. Close attention to this problem may, and often does, become as important as the technique used in drilling in its effect on over-all costs. —**The End**



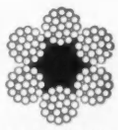
OVERCOMING ABRASION—Wire rope takes a beating on some jobs by abrasion. It is squeezed in multiple layers under tremendous pressure on rotary drilling drums in the Texas oil fields. In the Northwest it drags under heavy logs.

In this Arizona mine it is scraped over rocks to operate a slusher. Everywhere it is rubbed severely on winches that do not wind smooth. Under such conditions Red-Strand 6 x 19 Seale wire rope will last longer and save you money.

What can you do better with 6x19 Seale Red-Strand?



6 x 19 Seale



6 x 19 Filler Wire

6 x 19 Seale has the same strength and weight as the more frequently used 6 x 19 Filler Wire, but the arrangement and size of the wires is different. You can see in the diagrams that the outer wires are fewer in number and larger in size. They provide *high resistance to abrasion* and greater wearing quality with somewhat less flexibility.

It's the perfect rope for certain jobs. Would it solve a problem for you? Be less trouble? Save more money? A Leschen man is near you. Perhaps he can help. Leschen is providing *longer-than-expected* wire rope service to industry everywhere.

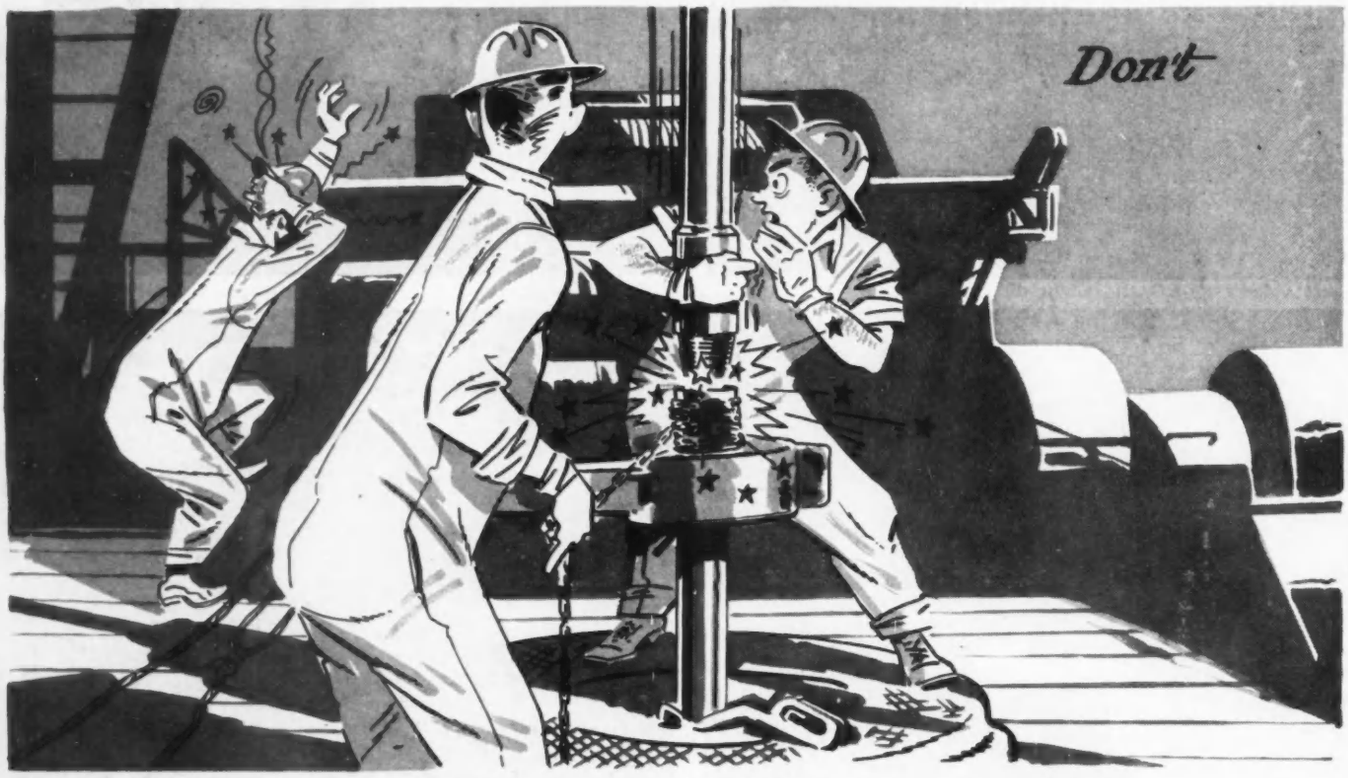
Send for the 64-page Leschen Wire Rope Handbook. It describes Seale and all other Red-Strand wire rope constructions.

LESCHEN WIRE ROPE DIVISION
The Watson-Stillman Company
(A SUBSIDIARY OF H. K. PORTER COMPANY, INC.)
St. Louis 12, Missouri

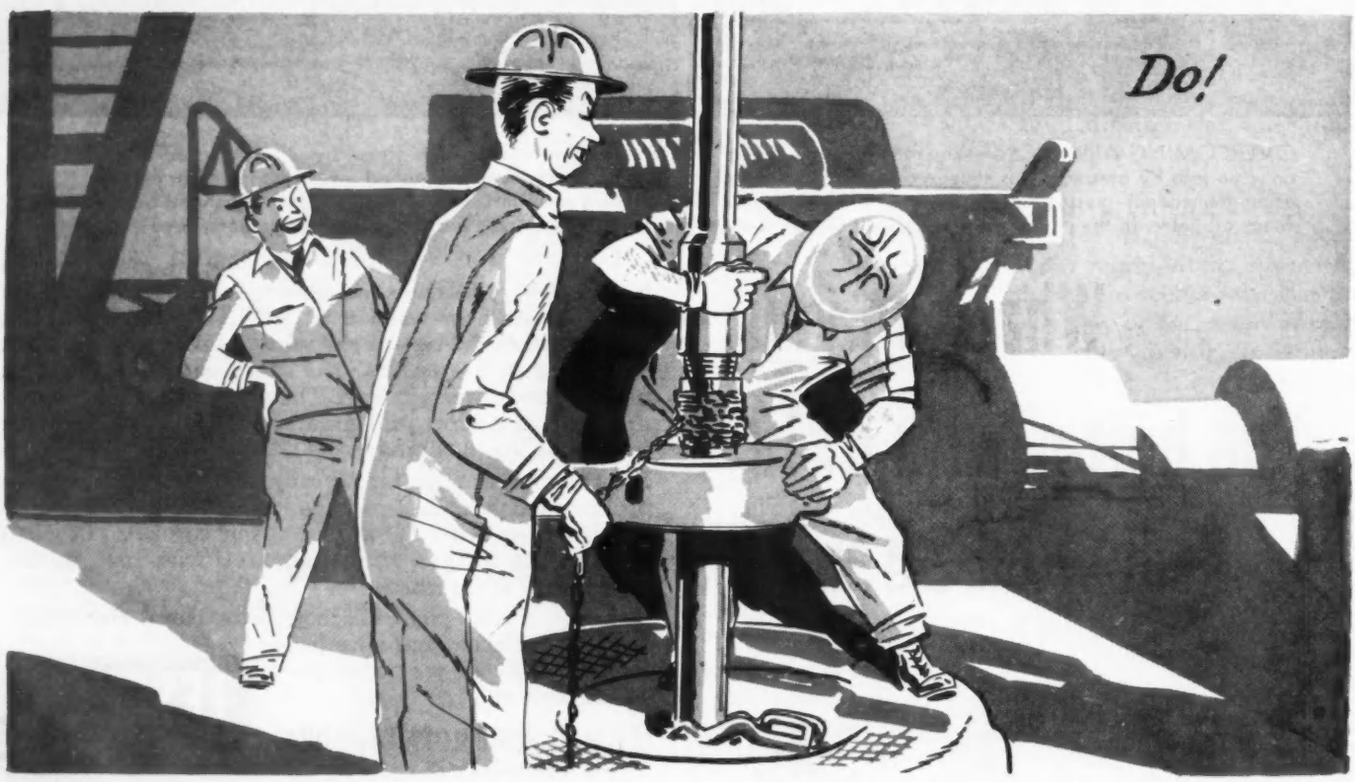
LESCHEN
HERCULES *Red-Strand*
WIRE ROPE

World Oil Graphics

Drill Pipe Care

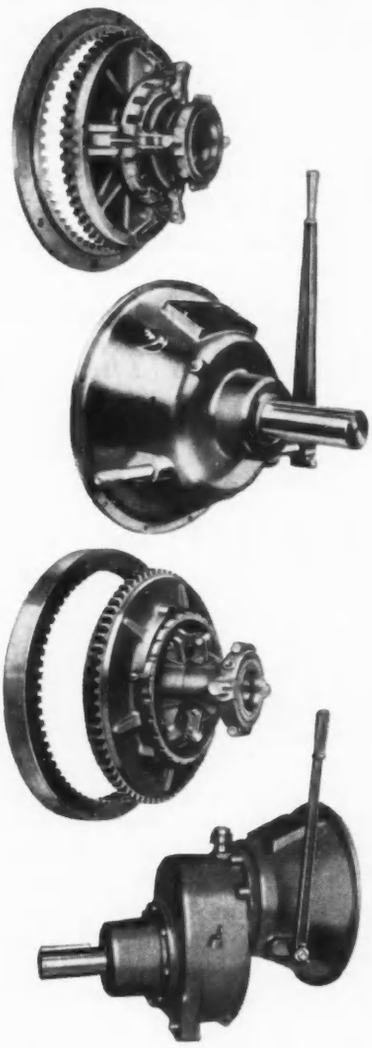


Striking pin end of drill pipe on shoulder of box causes indentation; may cause washout later.



Take care in lowering pin into box. Using extra seconds in joint make-up may save long fishing job.

SERVICE
for
ROCKFORD
Heavy Duty
CLUTCH AND POWER TAKE-OFF USERS



ROCKFORD Heavy Duty CLUTCHES, POWER TAKE-OFFS and SPEED REDUCERS are standard equipment on various makes of industrial engines. They are available in standard sizes ranging from 125 foot pounds to 2100 foot pounds torque. Clutch sizes range from 6½ to 18 inches, single and double plate — to fit standard S. A. E. flywheel housings. These complete, self-contained power take-off units are being used extensively for heavy duty gear-tooth drive type application to gasoline and diesel engine powered drilling, pumping and servicing rigs. Their precision manufacture, conservatively rated capacity, field proved stamina and unusual ease of adjustment are lowering upkeep costs throughout the petroleum producing areas.

Send for This Handy Bulletin

Gives dimensions, capacity tables, specifications and typical applications of ROCKFORD CLUTCHES and POWER TAKE-OFFS.

ROCKFORD CLUTCH DIVISION
BORG-WARNER
1323 Eighteenth Avenue, Rockford, Illinois

These ROCKFORD DISTRIBUTORS and DEALERS carry a stock of clutches, power take-offs and replacement parts to insure ROCKFORD clutch users prompt delivery and service.

Continental Sales & Service Company, Los Angeles, Calif.
Lightbourn Equipment Company, Dallas, Texas
Atlas Auto Parts & Grinding Co., Louisville, Kentucky
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Auto Clutch & Parts Company, Chicago, Illinois
Auto Gear & Parts Company, Philadelphia, Pa.
General Machine Parts, New York, N. Y.
Highway & Industrial Equipment Co., Inc. Raleigh, N. Carolina
R. Angus (Alberta) Ltd., Edmonton, Alberta, Canada
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Wherever industry uses heavy duty clutches or power take-offs there is a ROCKFORD distributor conveniently close at hand to supply ROCKFORD Heavy Duty CLUTCHES, POWER TAKE-OFFS and replacement PARTS for numerous types and sizes of each.

IN THE OIL FIELD

Diesel Lubricants Are Getting Better

Those used today are far superior to 15 years ago. And as changes and improvements are made in diesels, improved oils will progress.

By ROBERT A. PEJEAU, Cleveland Diesel Company

IN A DIESEL engine, as in a gasoline engine, the primary functions of the lubricating oil are to reduce the friction between moving parts and to dissipate heat. The importance of heat dissipation cannot be overemphasized. It is not sufficient only to supply oil to a bearing; the oil and heat must also be taken away.

Almost any mineral oil of the proper viscosity accomplishes these two main functions in a diesel engine, but various types of oil exhibit widely different characteristics affecting engine cleanliness, wear, and lubricant life. After consideration of these requirements is made, the similarity between diesel engine and gasoline engine lubrication ends. The lubrication requirements of a diesel engine are more severe than in other internal combustion engines. The temperatures are higher and this increases the rate of oxidation of the lubricant; the oil is subject to more contamination due to the type of fuel used, and the piston ring or cylinder wear is greater because of the higher compression and firing pressures involved.

For large, slow-speed diesel engines, straight mineral oils are adequate for satisfactory performance. In the case of modern, high-speed diesel engines, it is apparent that these oils are not meeting the severe operating requirements.

As a result of improved refining techniques and the development of chemical formulations which are added to the oils, the lubricants available today are far superior to those in use 15 or even five years ago. It is paradoxical that the necessity for the addition of chemical formulations, as used in present day lubricating oils, was brought about by improved refining techniques. Refining is merely a process of conditioning and purifying crude oil. However, as refining becomes more thorough so that more and more impurities are removed, some of the desirable constituents are also removed. In order to supplant these desirable constituents, chemical formulations commonly referred to as additives were developed. Evidence of the success of these oils is the fact that practically every filling station in the nation carries additive type or heavy duty lubricating oils for passenger cars.

Even though additive lubricating oils are more expensive than the straight mineral variety, they are much cheaper to use from an overall economic consideration. A diesel engine can operate on a straight mineral oil but the oil service life will be shorter; the engine wear rate will be higher, and the frequency of engine overhauls will be increased.

It is not intended to infer that additives are the answer to all lubrication problems in diesel engines, for with higher concentrations of these materials, other difficulties have been encountered. In any event, the possibility of further lubricating oil development is still as bright as it was on the day Col. Edwin L. Drake drilled his now-famous well in 1859.

Changes and improvement in diesel engine designs are inevitable and the need for improved oils will move along with this progress. Synthetic lubricants are already providing hints of interesting possibilities.—**The End.**

ACKNOWLEDGMENT

Taken from General Motors, *Engineering Journal*, Vol. 1, June-July 1953, No. 1.

Remember the wild days of 1919? Ranger, Burkburnett and Breckenridge. Taken from the pages of *The Oil Weekly*, here are some highlights . . .

Out of the Driller's Past

Human Fishing Tool

"There's a lot of fun in being a driller in the oil fields of Texas. These drillers sometimes take flights in the air and then again they go down to the bottom of some of the wells when the fishing tackle fails to grab some piece of tool that must come out.

"Recently W. M. Grant, driller for the Bennett Oil Corporation, near Jacksboro, Texas, got mad when he failed after two days fishing to get a grip on a stem that had fallen to the bottom after breaking in two. Then he let a chicken—a hen—to the bottom of the 270-foot hole to see if the air was good. It was. He then instructed the boys to let him down so he could straighten the stem so it could be pulled to the surface.

"The blamed thing jammed and then he had to make a second trip. The second pull broke the cable and his third trip to the bottom proved to be without final result, as did the other trips. He did his part all right, but something just had to happen. He is now using grappling irons in the good old way and expects to be drilling again shortly.

"Grant is one of those slim chaps you have heard of. The hole is 24-inch and naturally he had no trouble slipping up and down."

From The Oil Weekly, Sept. 13, 1919.

BAASH-ROSS "DU" ROTARY SLIPS

the outstanding choice of the industry

...because they are unitized for uniform gripping.

...because they are light weight and balanced.

...because their segmented liners are easily replaced.

...because two basic body sizes can handle all pipe sizes from 2⅜" through 7" O.D.

...because their perfected gripping surface HOLDS!

BAASH-ROSS TOOL COMPANY

Los Angeles...Houston...Oklahoma City...Odessa...Casper...Canton, O....New York City

Kilgore Gumbo Bit

An advertisement in the Oil Weekly September 1919, told of a gumbo bit with the following description: "Don't waste time spudding in gumbo. Use this bit and double your progress in the stickiest formations. Gumbo will not cling to the raw-hide cuff, therefore bit will not ball. For the best results use in solid gumbo strata—gravel and boulders will tear the raw-hide and reduce its efficiency.

The Oil Weekly, Sept. 27, 1919

How to Find Oil

According to *State Press* in the *Galveston News,* there is but one sure way to find an oil well. His advice is, "Locate a pipe line and follow up the line until you come to the well."

The Oil Weekly, Oct. 4, 1919

To Oil Wood Block Paving

Because the wood block paving in Wichita Falls has a habit of getting out of bounds or either floating off or forming itself into hills and valleys after every rain, the city authorities are going to oil it, using the same asphalt base oil as is used in oiling roads. Sometime ago this was done on one street as an experiment and since that time there has been no trouble there."

The Oil Weekly, Sept. 27, 1919

Amateurs and 'Damp Fools'

"That there are fields where the rotary is superior to cable tool goes without saying. And in the rotary field, the drillers think that the operators of standard cable tools are all amateurs. In a standard tool field, the toolers think that the operators of rotaries are all "damp fools." That just about sizes up the situation. The structural conditions vary greatly and determine the kind of machine to be used in any field, especially where the field is well defined. Where there is a soft or soil formation for several hundred feet without encountering any rock strata, the rotary can make a hole quicker than anything else, but the rock strata near the surface, is maintained by drillers, that the rotary does not have sufficient power to force it through, and that nothing but a standard outfit is practical. The rotary bit people deny this.

"It is also maintained that in drilling new territory there is a chance of plastering off a possible producing sand with the rotary, and thereby losing what might otherwise be a commercial well. The efficiency of this theory is generally recognized in wildcat work, and this has been especially true in the development of the new territory in central West Texas.

"A rotary outfit was used in a test in Brown County with unsatisfactory results. The rock encountered near the surface was hard to negotiate, and the hole was never completed, after months of effort. A few rotaries are now being used in this territory by operators who have strong faith in them under all circumstances. One is being used in the test in Parker County, and another one in Erath County; but all are very much in minority.

"As a rule, it takes from 50 to 120 days to make a 3300-foot hole in West Texas. With more than an average of grief, the time may run to 6 months, and it has taken as long as a year to complete some tests where bad fishing jobs were encountered. In spite of the time element, however, standard tools will make the majority of holes in the West Texas fields.

The Oil Weekly, Oct. 18, 1919

Guy Mabee Drilling Company

has the light, medium or heavy duty Rotary Rig to push your hole down faster, at lower cost, throughout the Permian Basin of West Texas and New Mexico.

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ATlantic 1-6970 JOSEPH F. DUDDY, MANAGER

Smart Boys

"Two brothers, barefooted and dressed in comfortable summer attire, aged 11 and 12 years respectively, are richer by $4500 than they were last week, all because they showed their thrift in a most telling manner. Much oil is going to waste in the new Northwest Burkburnett field on account of the inadequate pipe line facilities, but these youngsters secured their money on account of a broken gathering line.

"The boys saw the broken pipe and saw the released crude oil running off into a small ravine. They pressed a small donkey into service, hitched him to a rattle-trap spring wagon and started to hauling dirt to dam the ravine. After much hard work, they had a respectable dam that effectively held up with 3000 barrels of oil.

"The owner appeared on the scene about this time and he admired the pluck of the youngsters. He did not set up a claim to the oil. It had been his, but since possession is nine points of the law, the youngsters seemed to be the present owners. He offered them $1.50 a barrel for the oil that is worth around $2.40, originally his, and his offer was accepted. The barefoot youngsters perched themselves on the new dam and with stubs of pencils checked out the oil as it was being hauled away. It counted out 3000 barrels even and the boys got their money."

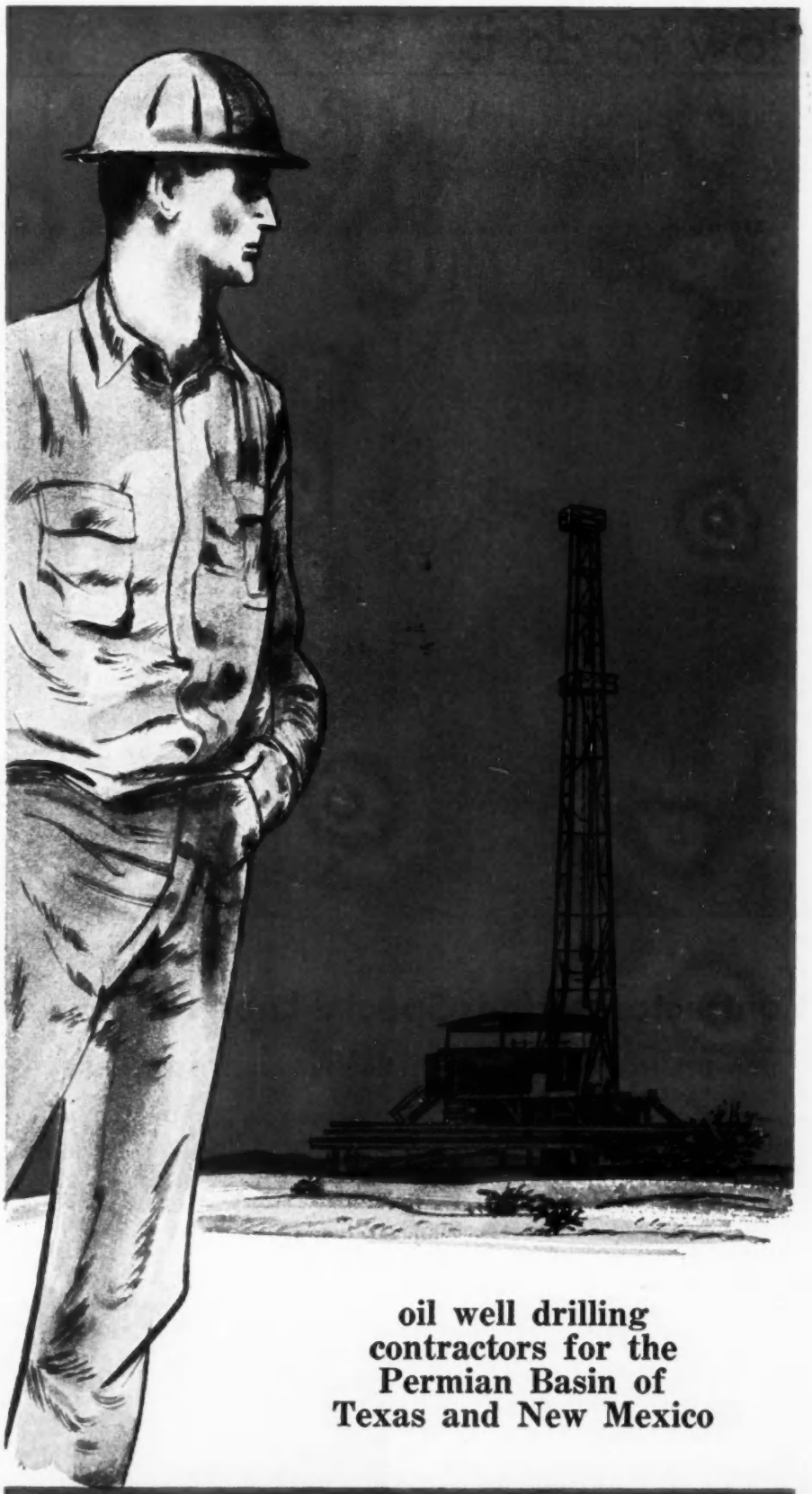
The Oil Weekly, 1919

Anybody Would Have Been Mad

"Some oil field superintendents dream of a heaven where there are no game law on teamsters, especially when roads are muddy, the drillers yelling for casing, and the weather is playing havoc with a fellow's corns. H. G. Blanton, a new superintendent of the Breckenridge field, forgot that this blessed condition is not with us now.

"He employed G. A. Lacey and five other teamsters to haul 45 joints of casing to his lease, agreeing to pay the men $15 each. When they arrived, they reported that they had found only nine joints where 45 should have been, but demanded the full price in payment. Blanton refused, but offered $12.50 to each man. Result was an argument from which Lacey emerged with a bullet-hole in his cheek."

The Oil Weekly. Oct. 4, 1919



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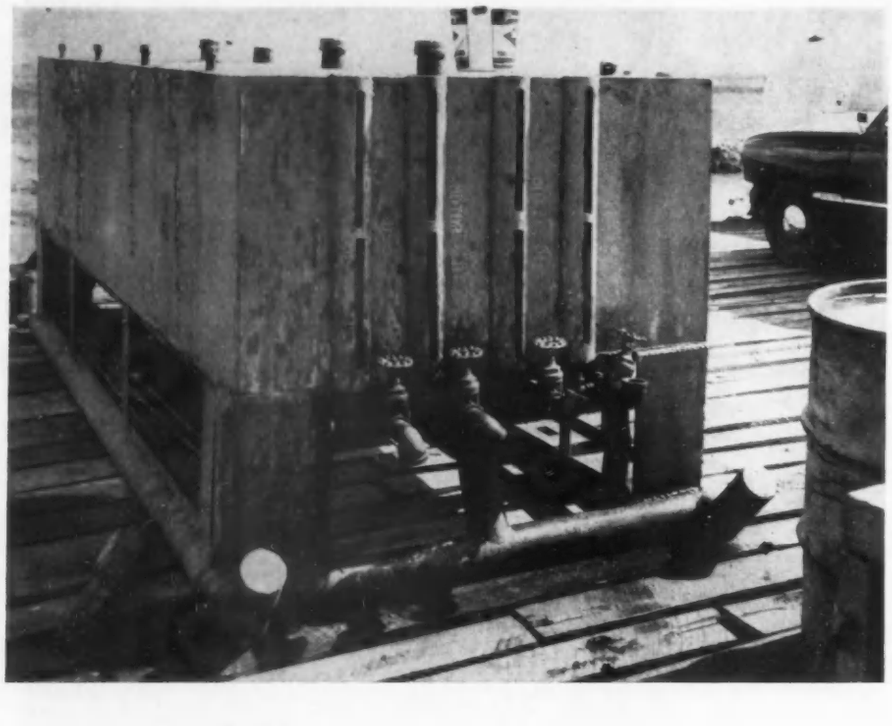


Contractor Designs Special Lube Dispenser

Meredith Drilling Company of Houston has designed a lube oil dispenser which tells the fluid level at a glance. Measuring 12 feet long by 5 feet wide by 2 feet deep, the rectangular tank is divided into four separate but equal compartments, with two-inch pipe outlets running from the bottom of each compartment to front of the reservoir.

The fuel tank is made of sheet steel, welded to angle iron supports. Refueling is by means of three-inch nipples welded into the top of the tank, with one-inch air inlets and caps as shown.

The tank is elevated on legs made of plate steel, welded to four-inch pipe skids. The legs are well braced and have storage areas built in.

The fuel outlet has a ¾-inch union welded into the side of the outlet pipe just behind the fuel valve. A special oil lubricator valve supports a glass tube indicator that marks the oil level.

Short pieces of four-inch pipe split down the diameter are welded as cover protectors for the glass. Slots are cut along the length of the tube so that the level may be read.

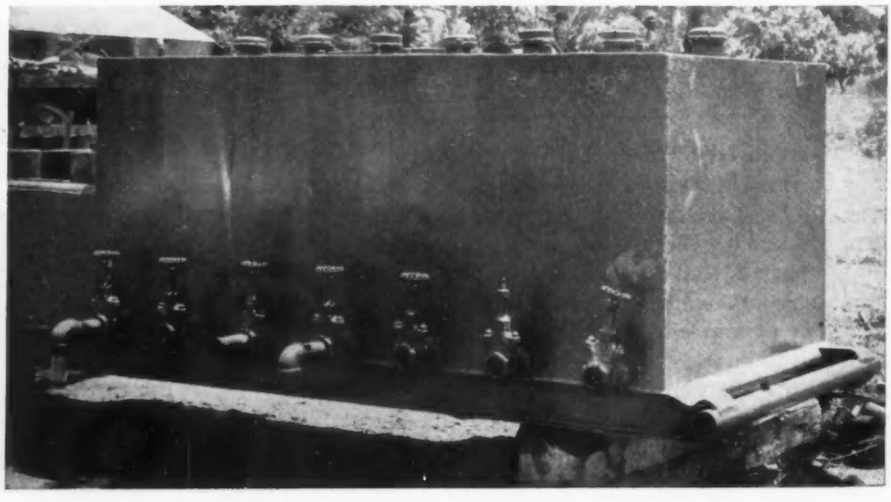
Lube Dispenser, Tool Box Provide Compact Unit

One Southwest drilling contractor has devised a unique way of conserving valuable hauling space by incorporating the lube oil dispenser and tool box into a compact unit mounted on a common skid.

The lube oil dispenser has been divided into seven equal compartments with three-inch pipe nipples welded into the top as refueling inlets. Pipe caps or flat bull plugs act as caps to each compartment inlet.

The seven compartments are divided into kerosine, top oil, 30 SAE, 50 SAE and 90 SAE storage.

The two-inch gate valves serve as fuel regulator valves at the outlet. Sheet metal has been welded on a metal frame to form the heavy duty tanks and a welder has brazed the names of the fuels in the compartment with a welding rod on the outside of the tank. To the left of the lube tank is the storage area which will accommodate heavy fittings, liners, and other rig equipment.



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Pipe Stripping Made of Used Wire Rope

A large drilling contractor operating a rig east of Artesia, N. M., has utilized the cutoff portion of the drilling line to serve as pipe stripping. Instead of transporting wood strips (to be placed between the layers of drill pipe) to rank wildcat locations, this company has used wire rope wound meanderingly across the top of the one layer of pipe to serve as the stripping.

Pipe is less likely to be bent because considerable support is offered by the rope's meandering pattern. Care must be exercised in handling and laying down the pipe on these strips, since this metal-to-metal contact could be harmful.

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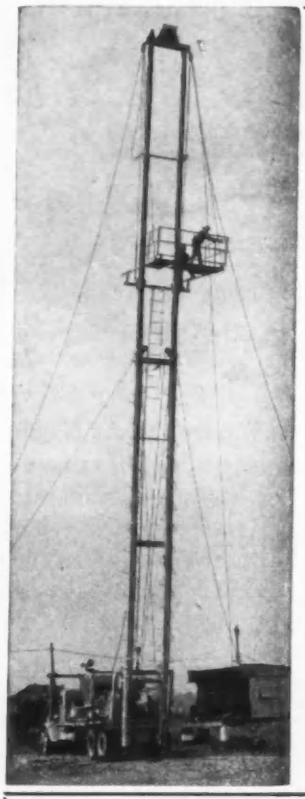

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PORTABLE TELESCOPING POLE MASTS—

This S & R double ladder mast is of heavy welded steel construction, and is fabricated of 10¾" pipe and 8⅝" pipe. Over-all dimensions when erected 87 feet to crown support beam and 52' when telescoped in traveling position.

Approximate weight of the complete equipment is 12,000 lbs.

The complete assembly includes the (1) poles, (2) breakdown shaft assembly, (3) attached racking platform (which positions itself when poles are raised), (4) pole adjusting screws, (5) a sheave assembly to be mounted on truck or trailer for raising the poles, (6) and a four or five 24 inch sheave crown block for ⅞" line.

Available for truck, trailer, or skid mount.

For additional information write, wire, or phone.

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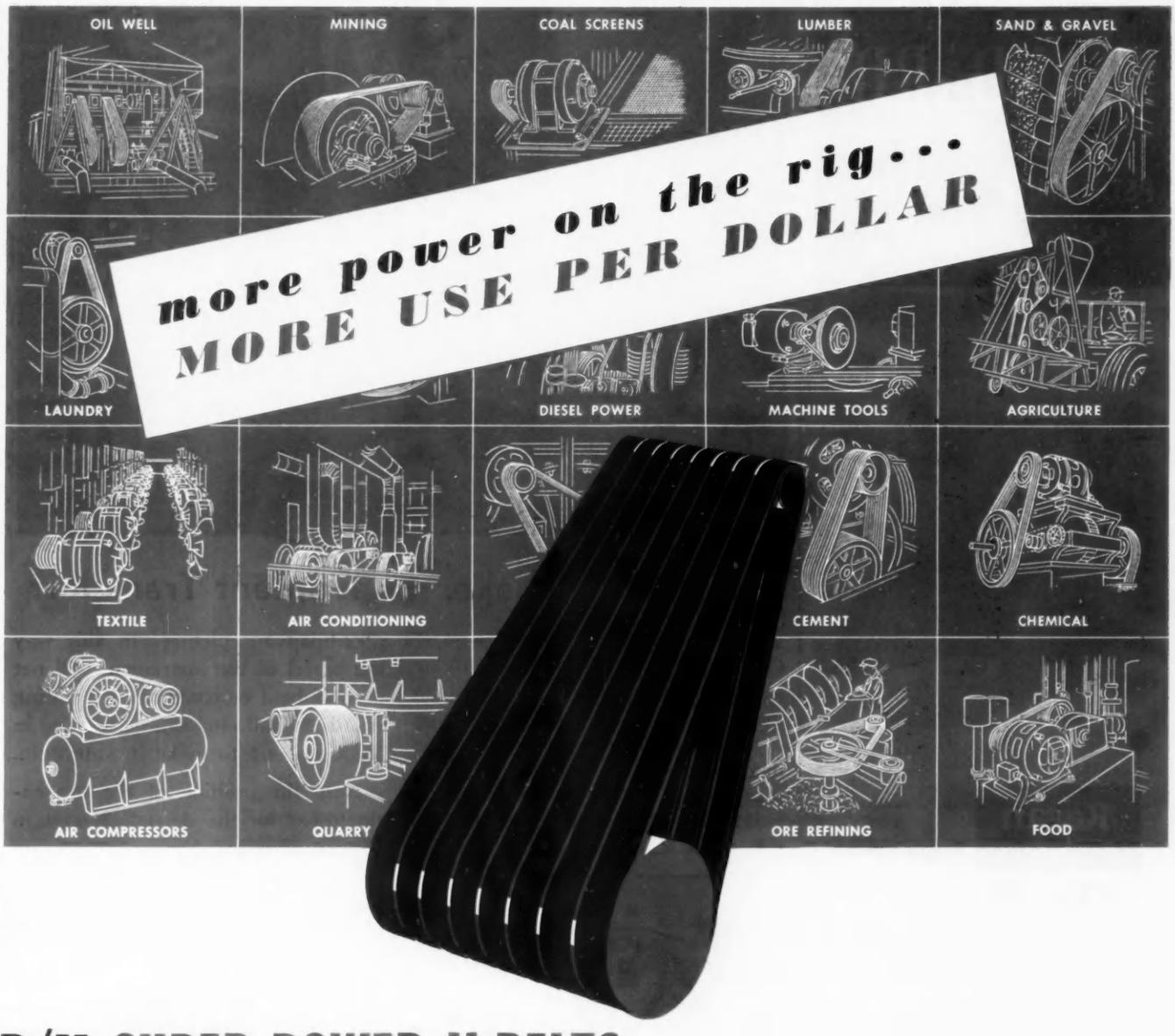

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Today's bigger rigs, higher rig floors and heavier power loads demand greater strength and more power delivery than ever in V-belt drives. R/M Super-Power V-Belts have that extra strength and power. With R/M Super-Power V-Belts you get 40% greater horsepower capacity than with regular V-belts. A combination of new synthetic fibers in the V-belt strength member provides greater resistance to heavy shock loads . . . virtually eliminates belt stretch and matching problems. R/M Super-Power construction, plus straight side-walls, means better belt tensioning and grip, less slip . . . more power delivered on the drive—*extra* power for your drilling and pumping operations. In addition, R/M Super-Power V-Belts are oil-proof, non-spark and heat resistant.

These features add up to "MORE USE PER DOLLAR" when you specify R/M Super-Power V-Belts for your drilling rigs and pumping units. Write for a copy of Bulletin 6628. And inquire also about other R/M V-Belt constructions, flat belts and rubber hose specially engineered by Manhattan for use in the oil field.

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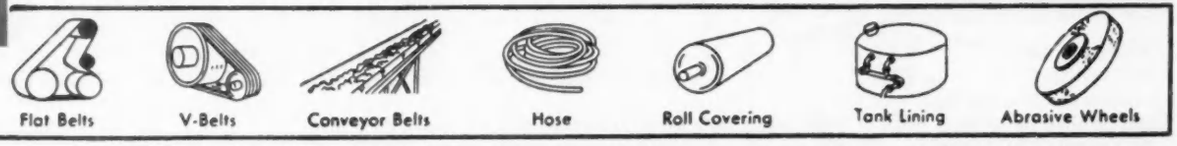

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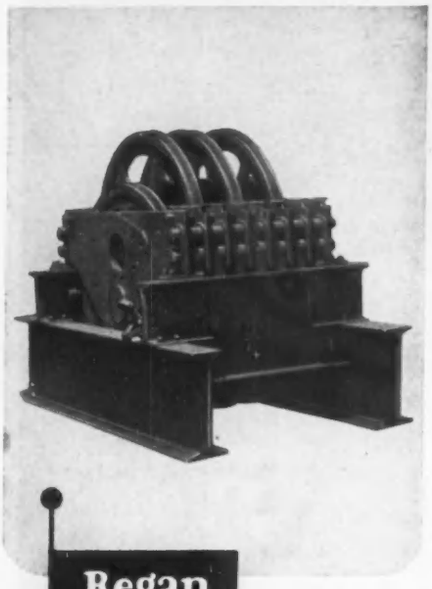

Regan type AN55
CROWN BLOCK

. . . built to stand up under the line speeds and loads applied by the largest drilling rigs. Ball bearings have been used to carry the thrust loads and further reduce the side drag on the sheaves. Heavy roller bearings carry the radial loads. The basic Regan design of a rotating inner race ring has been kept but the inner race ring of the roller bearings is mounted on the sheave hub. A bolt through the sheave hub pre-loads the ball thrust bearings and removes all side play from the sheaves. Positive lubrication to each bearing. Capacity—600 tons. *Write for informative bulletin.*

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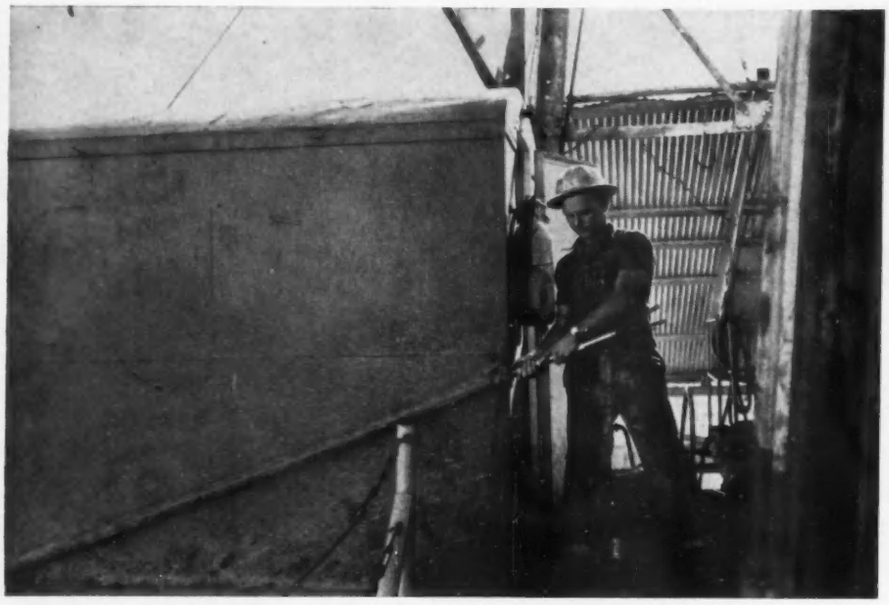

Pipe Holder Makes Convenient Transport

Southeastern Drilling Company of Odessa, Texas, has devised a unique way of transporting the straight hole instruments in a convenient pipe holder mounted on the side of the doghouse. Weld a piece of 2½-inch pipe, with a bull plug welded in the lower end, diagonally along the outside of the doghouse as shown in the accompanying picture. In this way the barrel of the instrument will not become bent or contaminated during transit. A bull plug can be screwed in the open end to make it watertight.

Note the position of the fire extinguisher on the derrick floor as a special safety measure.

A Cathead For Every Need

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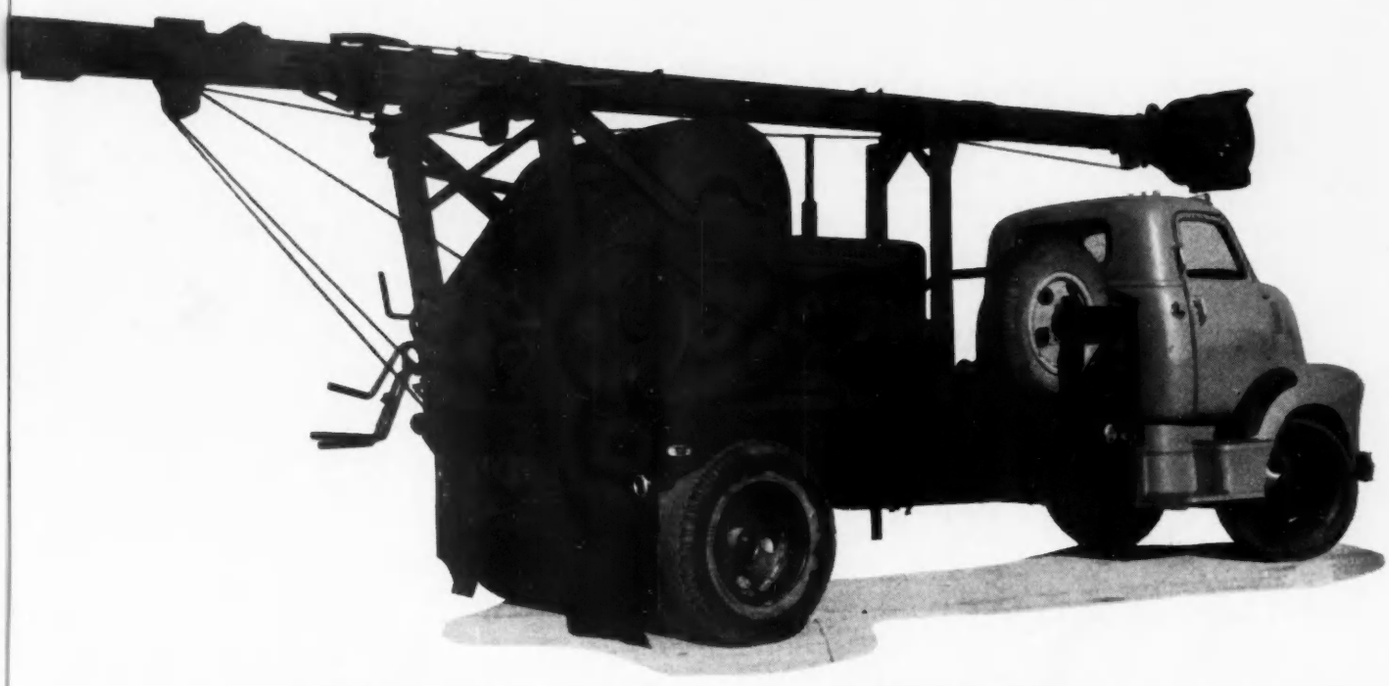

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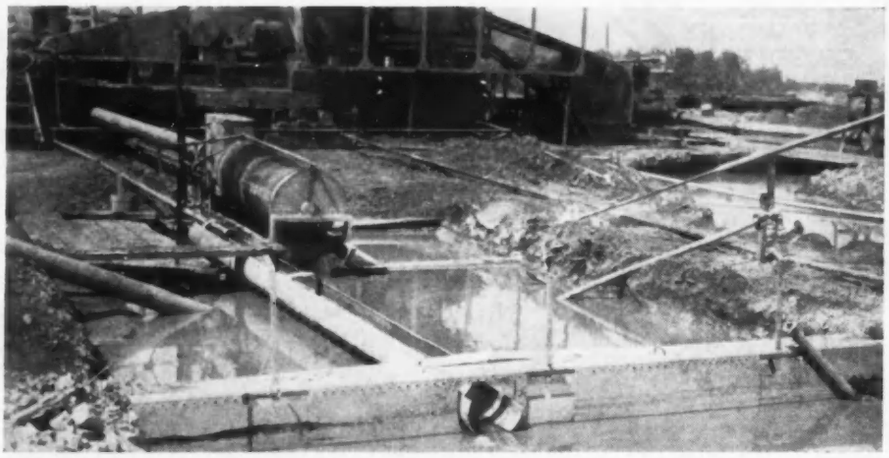
Steel Flume Bypasses Shale Pit With Cuttings

One drilling contractor operating in the Archer County field has devised a way to catch the drilling mud which has passed through the shaker and to carry it to a section of the pit where mud will not become contaminated with the shale.

When drilling in certain parts of the Hull-Silk Pool, this contractor found it necessary to separate the settling and shale pits with a steel dike as shown. A steel flume catches the drilling fluid.



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The condition of mud in the hole is recorded automatically during every minute of the drilling operations. Weight variations of less than 1/10-pound per gallon can be detected. Mud-O-Graf has been proved in fourteen years tough field service. It eliminates trial and error methods of adding weighting materials. It detects gas or salt water incursions which could cause blowouts.

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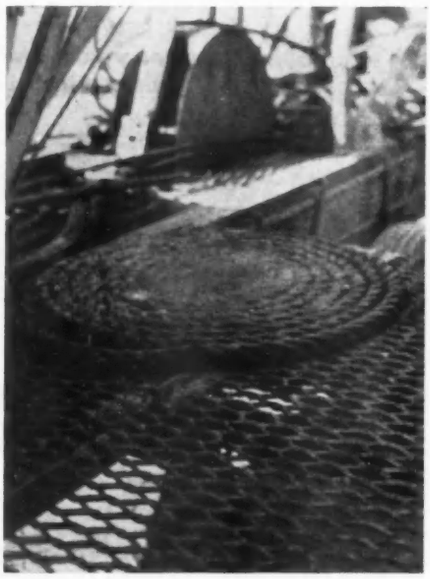
Discarded Cat Line Can Make 'Rug' for Driller

A discarded cat line can be made into a "rug" for the driller. This idea was conceived by a driller after standing through a tour on cold steel. He merely took a length of discarded cat line and coiled it Navy-fashion near the brake.

The circular coil is large enough to allow the driller freedom of movement. To hold each coil firmly to the inner loop, the cordage is nailed so that the entire unit resembles a huge pancake. In turn, this coil is fastened securely to the grating so it may be moved along with tools from location.



Christmas Tree Placed On Top of Derrick Floor

One major oil company in West Texas has devised a method of placing the test christmas tree on top of the derrick floor. This eliminates the

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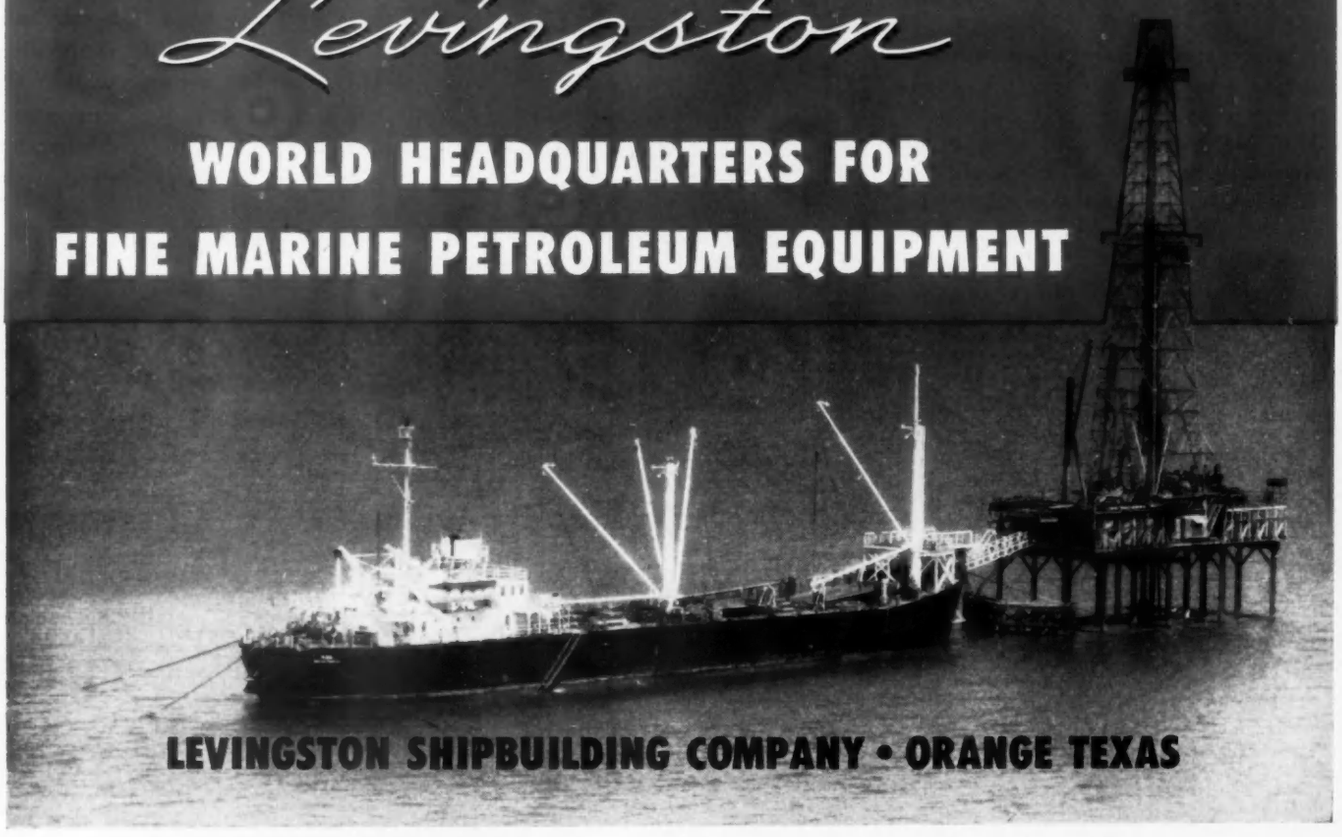

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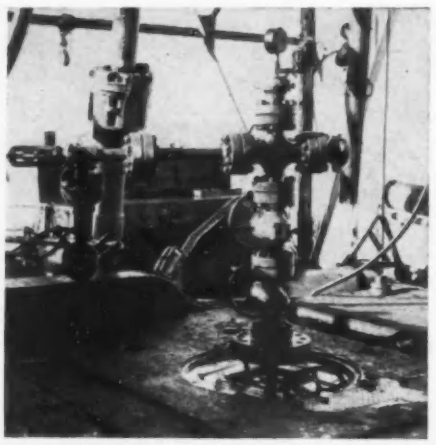
HINTS . . .

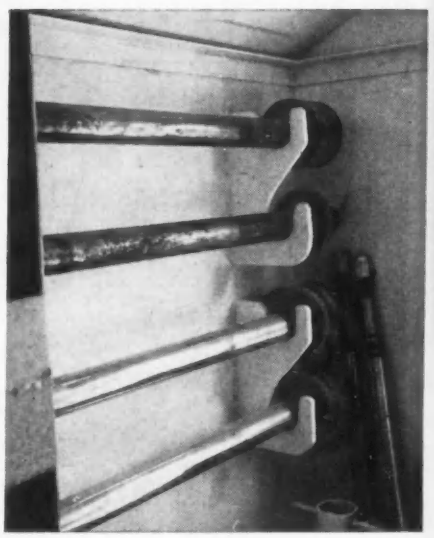
time usually required to take the blowout preventers off when the christmas tree is used for testing the well.

It eliminates the nippling up necessary to properly connect the christmas tree to the testing apparatus. They accomplish this by closing the blowout preventers on the tubing. Then the christmas tree is placed on the floor. The hole is not uncovered until they are ready to put the christmas tree on the wellhead for completion.



Notched Steel Plate Can Hold Rods and Plungers

One drilling contractor in the West Texas area has welded a one-half-inch steel plate, cut to the shape illustrated, to a vacant inside wall of the dog house. In this way expensive rods and plungers can be stored when not in use by resting the piston rod in the notch provided.



Pump liners are held in place by sliding them over short pieces of pipe welded vertically in the floor. Three-fourths-inch bolts or rods pass horizontally through the diameter of the pipe and extend several inches on either side so that the liners will not slip off or become damaged in transit. (Shown at lower right in photograph.)

EASY MONEY . . .

Like to cash in on your ideas and make some easy money? Send a picture and written description of some time-saving or money-saving device to aid drillers, to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas.

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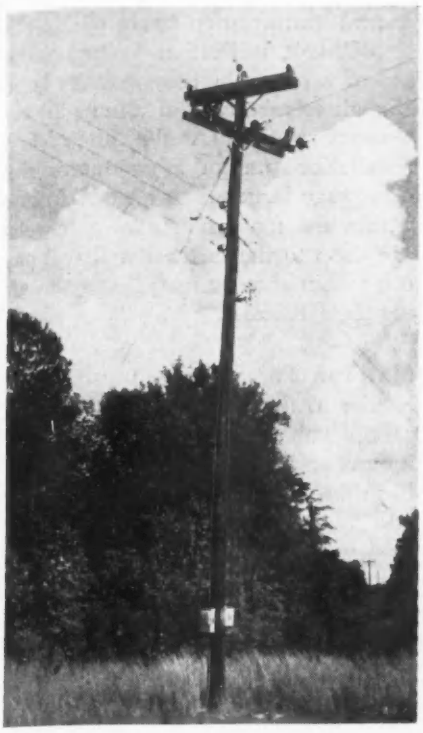


Fig. 1—Line poles serve multiple purposes in lease electrification.

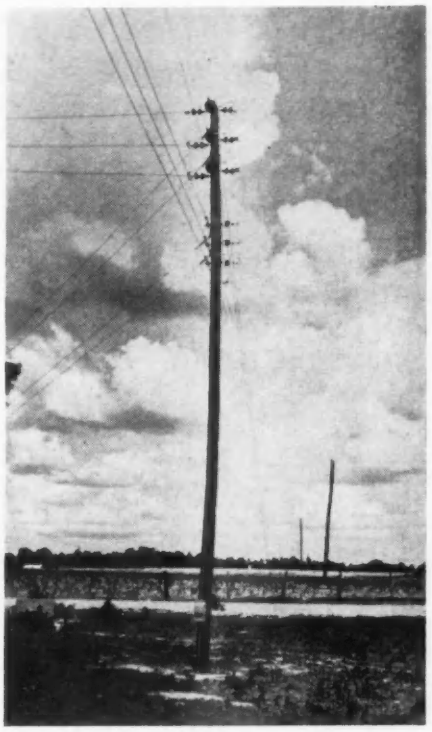


Fig. 2—As much as 660-foot spans are possible, using 45-foot poles for primary and 40-foot poles for secondary circuit.

High Voltage Distribution Systems Designed for Economy

In lease electrification, considerable savings can be attained by:

- **762- or 880-volt system with central transformer bank.**
- **Steel-reinforced aluminum cable.**
- **Cluster-type transformer hangers or a stub pole platform.**
- **Multiple service for each pole.**

By B. L. MOORE, Humble Oil & Refining Company, Houston.

ECONOMIC ADVANTAGES attained by higher voltages lie wholly in the distribution system. These advantages stem from three essential factors: (1) load transmitted; (2) distance a given load is transmitted; and (3) size of conductor for a given load. For example, four times the load can be transmitted over the same conductors the same distance at 880 volts as at 440 volts without exceeding the allowable voltage drop. However, care must be exercised in order that the conductors are not overloaded. The power loss is four times greater at 880 volts than the loss at 440 volts; however, the power loss per kilowatt transmitted is the same in either case.

A given load can be transmitted over the same conductor four times the distance at 880 volts as at 440 volts without exceeding the allowable voltage drop. The power loss is the same for each voltage, but the power loss per kilowatt transmitted per unit distance is one-fourth as great for the 880-volt system as for the 440-volt system.

The same load can be transmitted on one-fourth the conductor size the same distance at 880 volts as at 440 volts without the allowable voltage drop being exceeded. The power loss per kilowatt transmitted is the same at 880 volts as at 440 volts. Detail calculations to illustrate these three conclusions are presented in the appendix.

Distribution lines. There is no difference in the construction of 440-, 762-, or 880-volt distribution lines except for the size of conductor and the fact that fewer transformer banks are needed for the higher voltages. Fifteen years' experience indicates that there is no difference in the maintenance of a 762-volt system and an equivalent 440-volt system. Wherever there is a possibility of a sleet storm, lines are built to heavy-loading specifications. Outside such areas, lines are built to medium- and light-loading specifications with aluminum cable, steel reinforced (ACSR) conductor on 40-foot poles for the secondary and 45-foot poles for the primary with 660-foot spans, as shown in Figure 2.

Use of ACSR strung on eight-foot crossarms for the primary and spool bolts spaced 18 inches vertically for the secondary on 40-, 45-, and 50-foot poles have proved economical in the first cost and has practically no maintenance cost. Cost of ACSR is 50 percent that of hard-drawn bare copper. Due to its light weight, ACSR places less strain on poles and crossarms.

Transformer banks. Comparing the 440- and the 762-volt systems, the ratio of banks is generally 3 to 1 (Figures 7 and 10); and comparing the 440- and the 880-volt systems, 4 to 1 (Figures 8 and 13). Where three 75-kva, or smaller, transformers are used (Figure 4), they may be mounted on a line pole on cluster-type hangers. For 100-kva transformers, a small platform built on a line

Fig. 3—Automatic controls equipped with capacitors provide better voltage regulation.

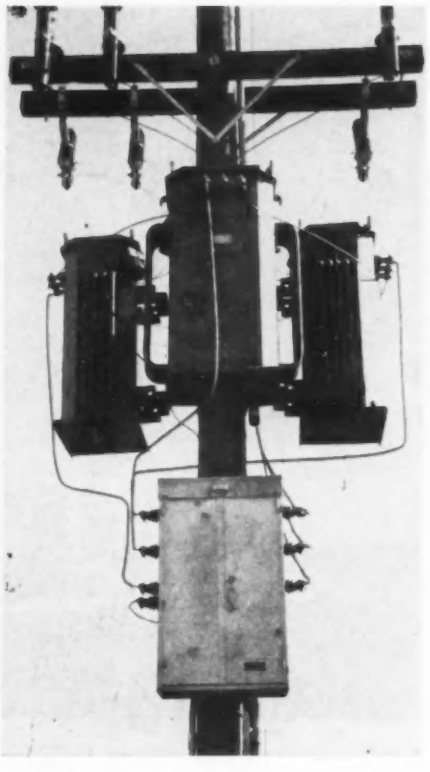


Fig. 4—Cluster-type transformers on hangers offer economy in lease electrification.

pole and a stub pole (Figure 5) is more economical than a two-pole structure.

Larger transformers are rarely used for oil field distribution, but when they are so used, a good practice is to employ a concrete slab and a two-pole structure as shown in Figure 6. When mounted on platforms or cluster-type hangers, top of the transformer is approximately 14 feet and the cutouts 18 feet above ground level to facilitate maintenance. It is essential to ground solidly the lightening arresters to a permanent water system or well casing in arid regions.

For a 762-volt system, single-phase transformers with a 240/480-volt secondary can be banked with the 480-volt connections in wye and the neutral grounded. However, for an 880-960-volt system, the single-phase transformer secondaries are normally 480/960 volts and can be connected for a 480-volt delta or 480-volt wye (831 volts line-to-line), as well as for the 960-volt delta utilization voltage.

To eliminate all danger of excessive voltage from the third or other harmonic, the primary and secondary transformer connections should be either wye-delta or delta-delta and, as previously stated, the neutral of the wye should have a low resistance ground of enough capacity to blow a primary fuse at 150 percent of the current rating of the transformer bank.

There appears to be no economy in the installation of individual three-phase transformers with built-in secondary, circuit breaker, and primary lightning arresters and fuses. A three-phase transformer must be at least full capacity for each motor, while a central bank can take advantage of the diversification factor. The individual transformer for a 20- or 25-hp motor must be 30 kva, or for a 3-, 5-, 7½-, or 10-hp motor it must be 15 kva. Only the 15- and 30-hp motors are properly fitted to a three-phase individual transformer.

Proponents of the three-phase individual transformer system state that the extension of the distribution line is not limited. This may be of importance in a few cases, but most fields are pretty well outlined by the time they go on artificial lift and the distribution system is laid out to take care of about 90 percent of the wells with provision for extensions to the other 10 percent. Consequently, in using a central transformer bank with 762- or 880-volt utilization voltages, the size of wire can be economically large enough to take care of almost all extensions required. At the time of first installation, use of a conductor size one gauge larger than needed to stay within the maximum allowable voltage drop to the farthest well will pay out within about three years by lowering the I^2R losses.

Motors. The greatest psychological barrier to the use of 762 or 880 utilization voltages seems to be in the motor and control. Actual practice has shown that there is little difficulty and very little extra expense on the part of the manufacturer in building the 762- and 880-volt motors and controls.

First consider the motors. Throughout the industry, 220/440-volt 9-lead motors are used on both 220- and 440-volt systems; 440/762-volt 6-lead motors are used on both 440- and 762-volt systems; and 440/762/880-volt 12-lead motors are used on all three voltages. There are very few cases where 220 volts is used for pumping and, consequently, the 12-lead motor could be used universally on any of the three voltages desired.

Cost of manufacturing any of the above motors is very nearly the same. There is a reasonable possibility that the 12-lead motor connected wye-delta would give excellent operation on 1100 volts.

Some producers have installed what has been called 440-volt, triple-horsepower-rated, 12-lead motors. Humble has had 15 years experience in the operation of 762-volt motors for oil-field pumping. The first motors used were delta-wound 220/440-volt reconnected in a local armature shop with six leads brought out for wye-delta operation and with no change in insulation level. Most of these motors have been in operation for 15 years and no unusual breakdowns have occurred.

Regarding enclosures, all-weather screened motors at 30 percent less cost than totally-enclosed, fan-cooled (TEFC) motors are very satisfactory for oil field conditions and are recommended as first choice.

Some advocate the use of 5- to 8-percent or even higher slip motors, which are justified by reduction of power consumption and sucker rod

Fig. 5—Stub pole transformer bank simplifies maintenance and installation.

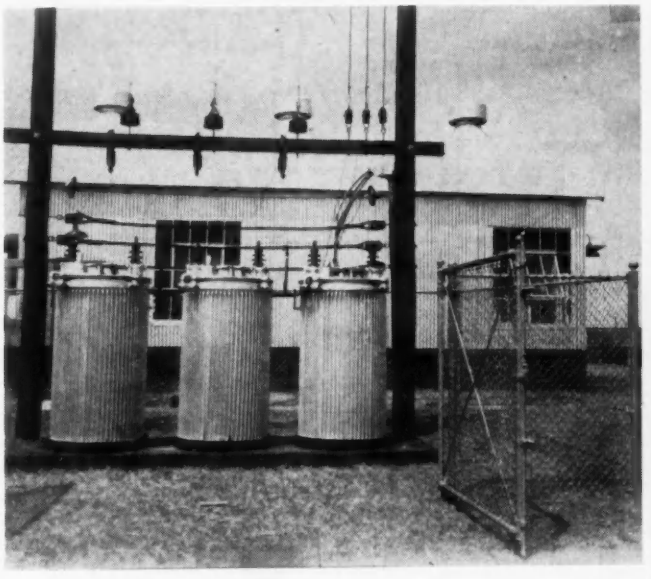


Fig. 6—Large transformers should be set on concrete slabs as shown here.

breakage. Experience has indicated 3- to 5-percent slip motors are very satisfactory, and that a normal slip, high torque, low-starting-current motor will start any load that it will pump, or vice versa. Wells have been drilled with the aid of deviation indicators so that the bore is straight, and are pumped with well-balanced units that operate at 10 to 15 strokes per minute. In some isolated cases and with very high pumping speeds, a 5- to 8-percent slip motor might have some merit.

Size of the motor will depend largely on the pump depth, strokes per minute, and the efficiency between the polished rod and the motor sheave, if the polished rod horsepower is known. When the pumping unit gear box is sized to the load involved, the motor should be approximately 135 percent of the polished rod horsepower. If there is no way of knowing the polished rod horsepower, the hydraulic horsepower required to lift the fluid from the pump setting to the surface may be calculated. Doubling this value results in overmotoring in more cases than undermotoring. If this value does not fall on a standard motor size, the next larger size should be used.

It has been stated that the wye-connecting of 440-volt motors to permit operation at 762 volts should be limited to well spacings of 660 feet or greater and where motors larger than 25-horsepower will be used. In 15 years of experience we have never encountered any conditions that would make a limitation of this kind essential. In fact, it has been found that 762-volt systems have enlarged capacities where smaller than 25-hp motors are involved. Because of mechanical strength, good distribution lines with less than No. 4 ACSR cannot be built, and where 10-hp motors and smaller are involved, lines extended from transformer bank or generating plant can be extended for as much as a mile with No. 4 or No. 2 ACSR on wells having 40-acre spacing. As far as spacing of the wells is concerned, those with less than 660-foot spacing will not work to any greater advantage for a 440-volt system than for a 762- or 880-volt.

Motor controls. In most cases, the pumping motor control is composed of a circuit breaker or a fusible disconnect switch, a magnetic contactor that should have three overload relays, a program timer, a hand-off-automatic switch, a 115-volt control circuit with a transformer, and usually an undervoltage relay or a time-delay relay. The control circuit transformer, not an expensive item, provides a simple means for using the same control on either a 440-, 762-, or 880-volt system.

A fusible disconnect switch suitable for 880 volts can be made for approximately the same cost as one rated at 600 volts. Preference is for the clapper-type contactor with suitable blowouts and liberal spacing for the higher voltages. One manufacturer has designed a vertical-motion contactor with a highly effective blowout that has given satisfactory service on 880-volt circuits. Where there is a network of motors and transformers, three overload relays are essential for both the delta- and wye-connected motors, even on 440-volt circuits, in order to have the maximum protection for the motor.

The program timer, or time switch, in the controls makes it possible to automatically control the operation of a pumping well. This feature is one of the most potent arguments for electrification. With this time switch, it is possible to pump a well a given number of days a month without human supervision. This is done by what is known as an omitting device. By proper plugging, this omitting device will omit as many days as are necessary to conform to proration.

Another feature of this clock is that many of them afford as many "on" and "off" periods as are desired per day to pump a well of known characteristics.

In case of a power outage it is usually desirable to have the motors start automatically after the power comes on. If there are enough motors to make it desirable to stagger the starting, the use of time-delay relays is recommended. If there is no harm in allowing all the motors to start simultaneously, the relays may be omitted. If it is desired to manually start each unit after an outage, only an

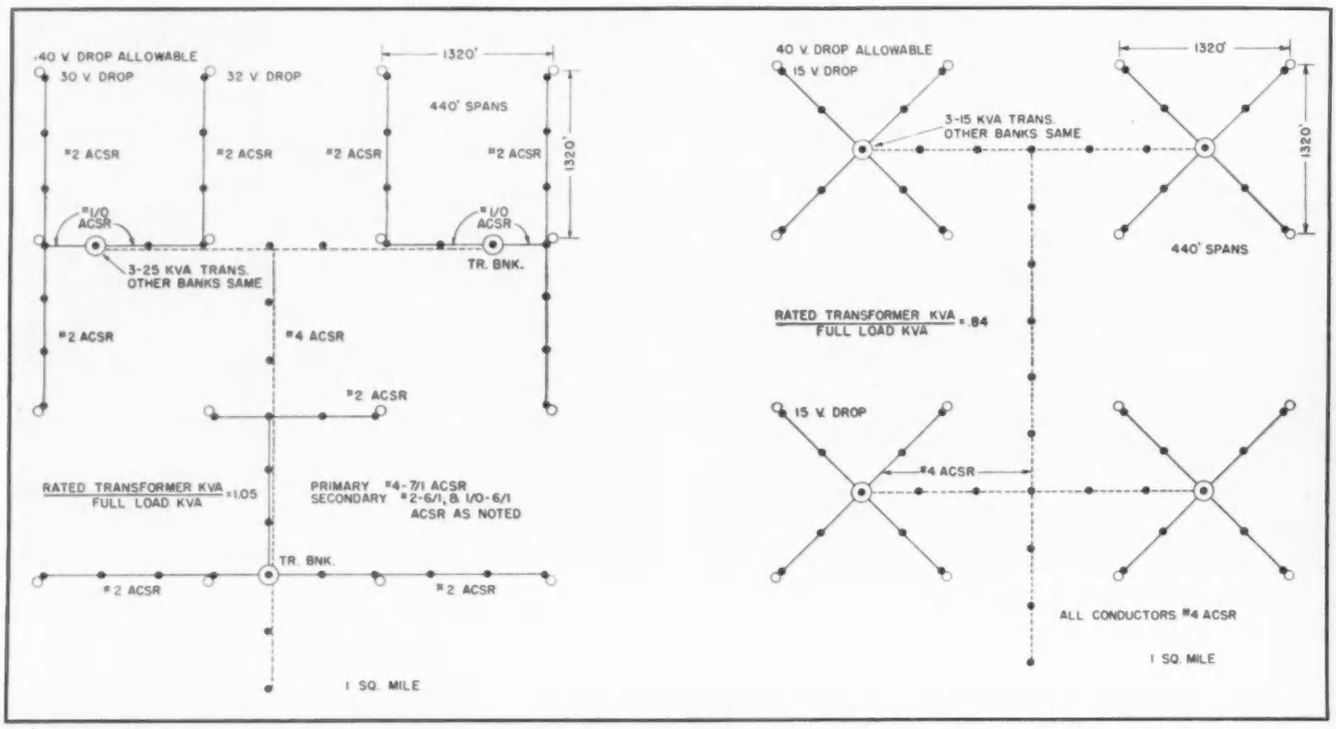


Fig. 7—440-480-volt system with three 75-kva transformer banks and 16 15-hp motors with capacitors.

Fig. 8—440-480-volt system with four 45-kva transformer banks and 16 15-hp motors with capacitors.

undervoltage relay is needed.

Manufacturers have followed the practice of putting meter protectors or lightning arresters in the pumping control and this has been generally accepted by many users without much question. It has been discovered that better protection was provided by mounting the lightning arresters on the service pole at the point where the service was connected to the distribution line. The ground lead from the lightning arrester was run from the foot of the pole and connected to a ground rod, and thence to the well casing. Before this method was adopted, extensive lightning damage in arid areas was experienced.

In 762-volt installations Humble follows the practice of mounting the fusible disconnect on the pole instead of in the control; running a three-conductor direct burial cable from the pole to the motor and a four-con-

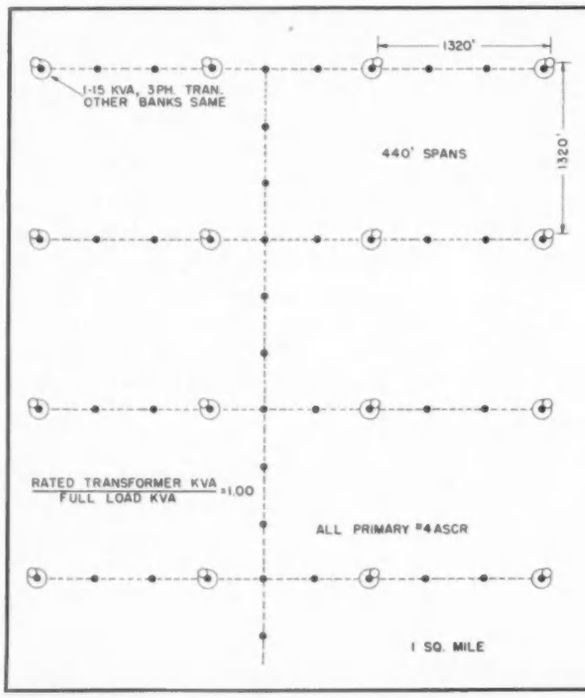


Fig. 9—440-480-volt system with 16 15-kva 3-phase transformer banks and 16 15-hp motors without capacitors.

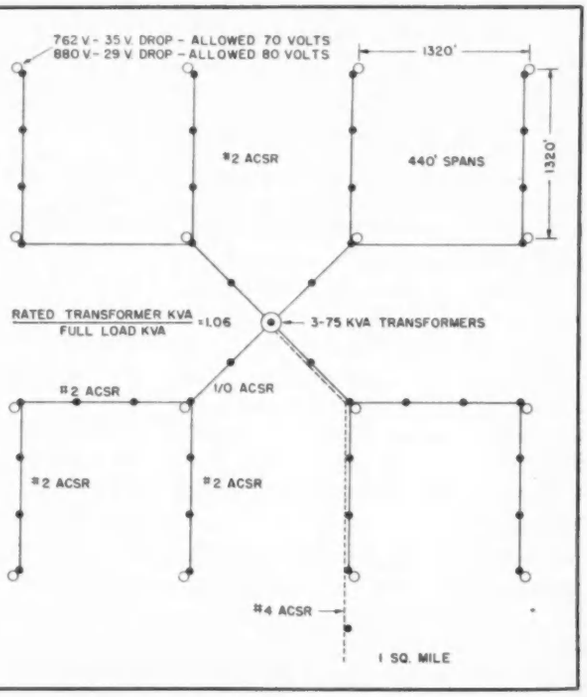
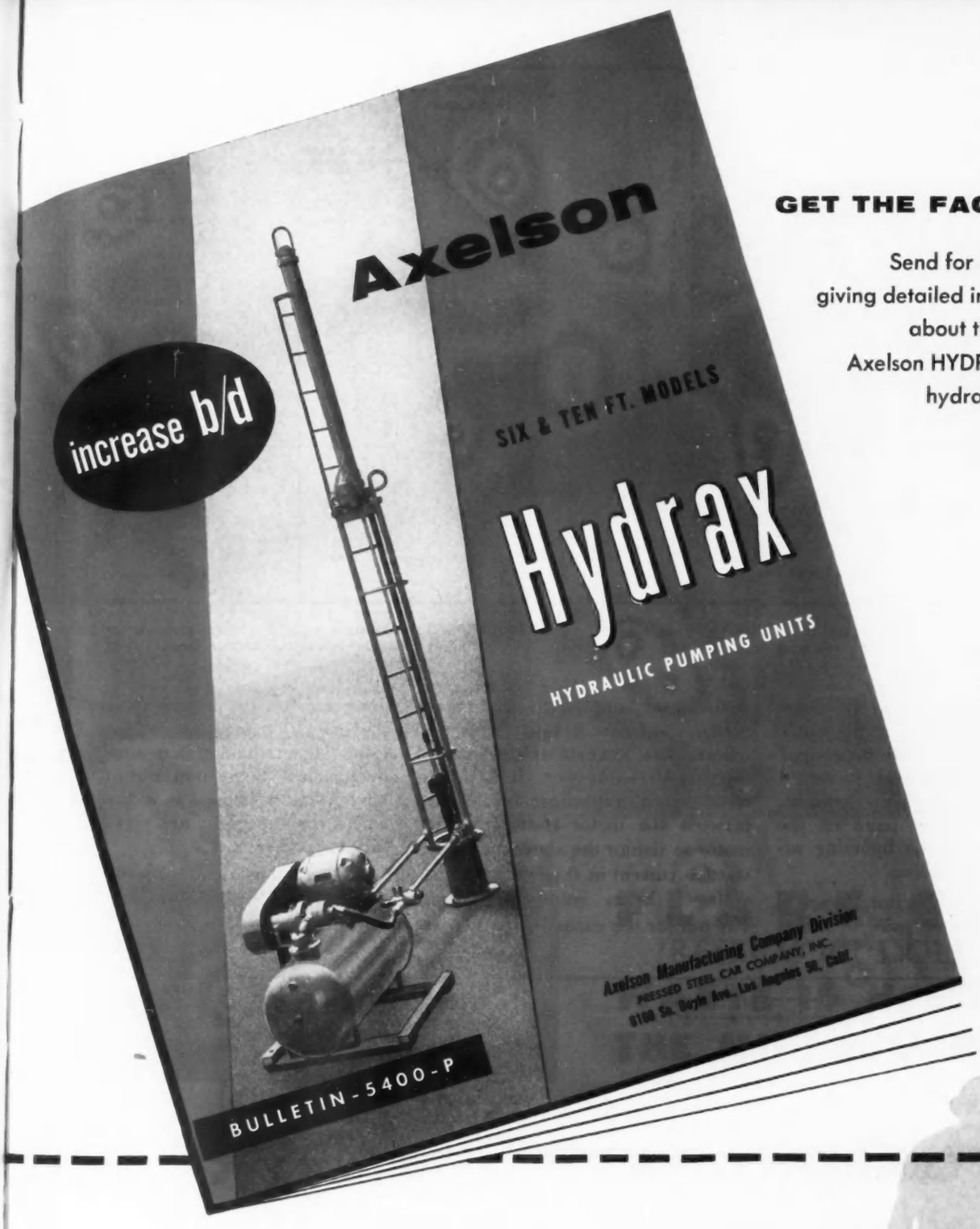

762 V - 35 V. DROP - ALLOWED 70 VOLTS
880 V - 29 V. DROP - ALLOWED 80 VOLTS
1320'
#2 ACSR
440' SPANS
RATED TRANSFORMER KVA / FULL LOAD KVA = 1.06
3-75 KVA TRANSFORMERS
1/0 ACSR
#4 ACSR
1 SQ. MILE

Fig. 10—762-831-volt and 880-960-volt systems with one 225-kva transformer bank and 16 15-hp motors with capacitors.



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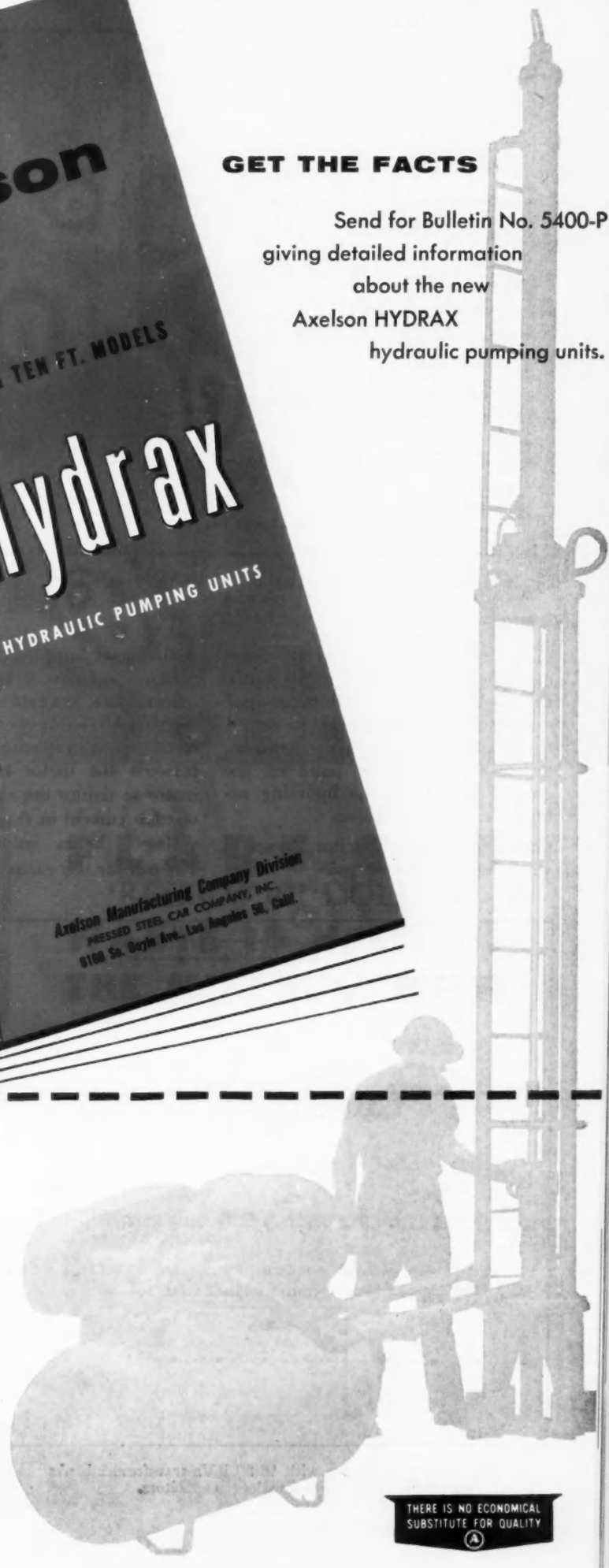

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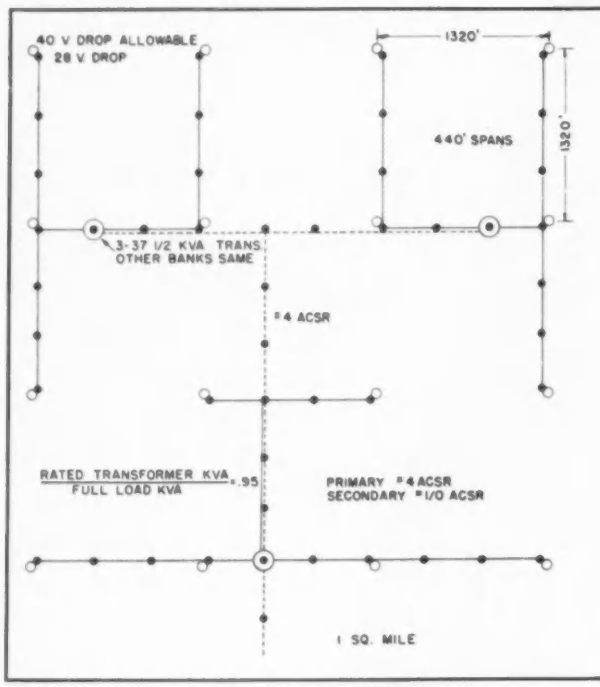


Fig. 11—440-480-volt system with 3 112.5-KVa transformer banks and 16 25-hp motors with capacitors.

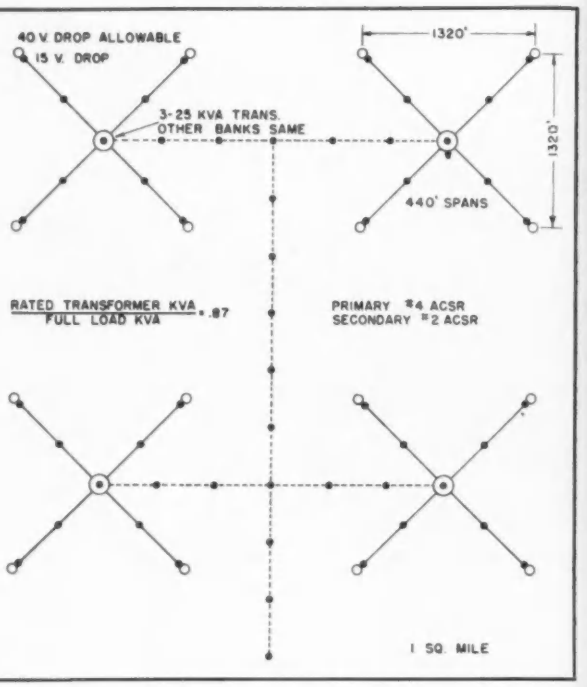


Fig. 12—440-480-volt system with 4 75-kva transformer banks and 16 25-hp motors with capacitors.

ductor neoprene cord from the motor to the control. At this point the motor neutral is grounded inside the control case and the ground lead connected to an outside grounding terminal, thence to the nearest point on the ground lead from the lightning arresters to the well casing.

Capacitors. The capacitor, Figure 3, when installed at the point of an inductive load, supplies the magnetizing current inherent in such loads and relieves the transmission lines of carrying this current. It is recommended that capacitors be installed between the motor starter and the motor to reduce the above-mentioned wattless current in the lines, thus providing a better voltage regulation. Pay out for the capacitors, which are approximately 20 percent the cost of the motor, comes from reduced I^2R losses and a reduction in required conductor sizes. Some power companies have what is known as a kva rate, where the capacitors are very necessary to good rate.

As thermal overload relays are rated to correspond with the ampere rating of the motor, the capacitors should

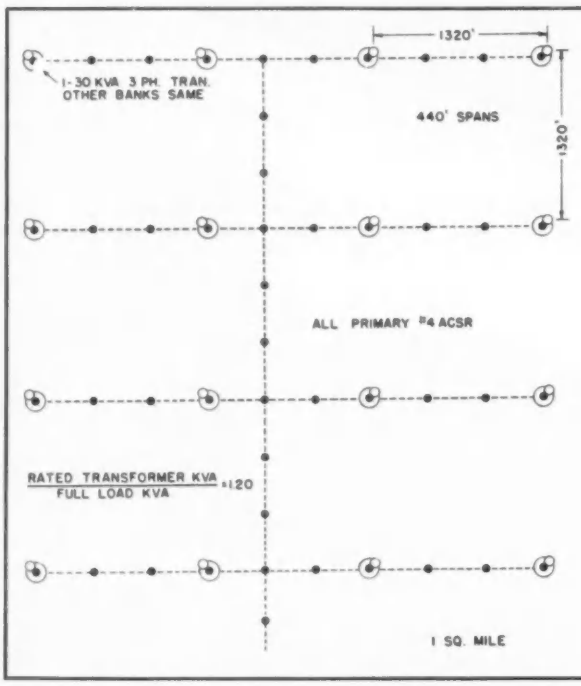


Fig. 13—440-480-volt system with 16 30 KVa transformer banks and 16 25-hp motors without capacitors.

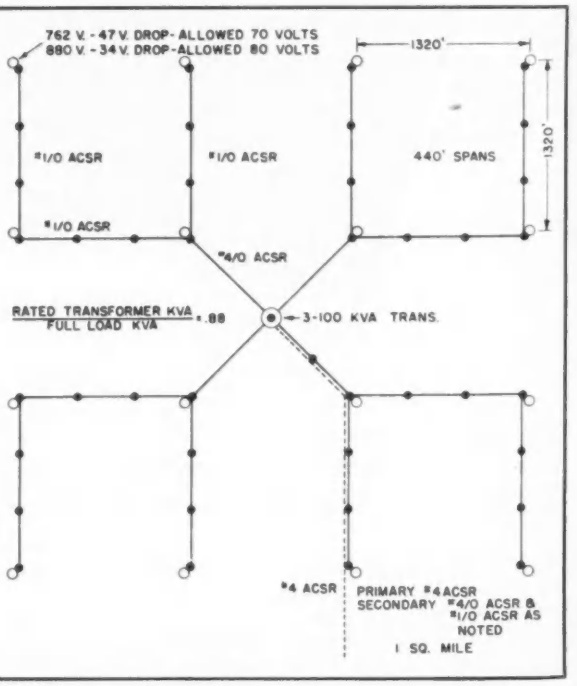
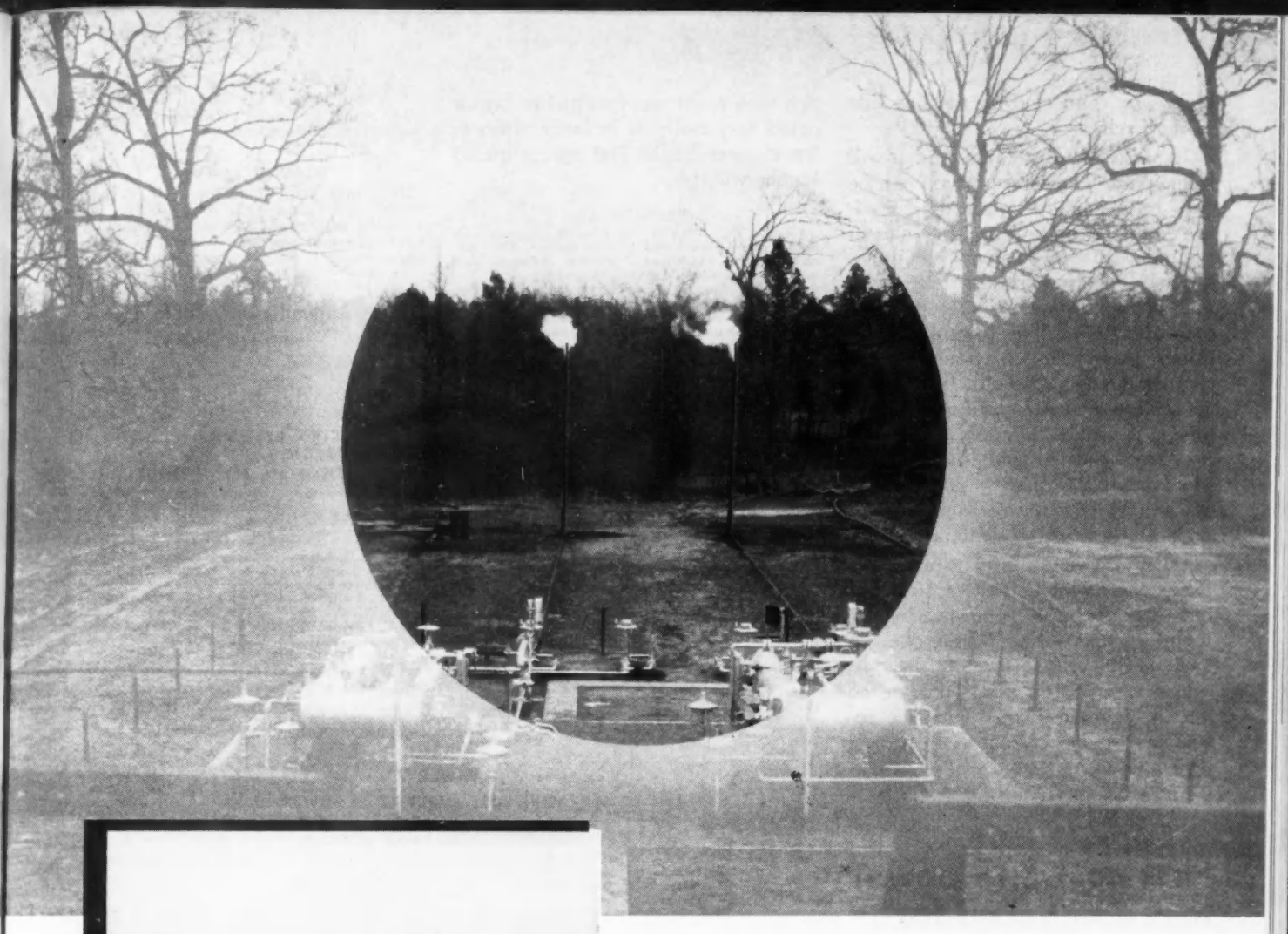
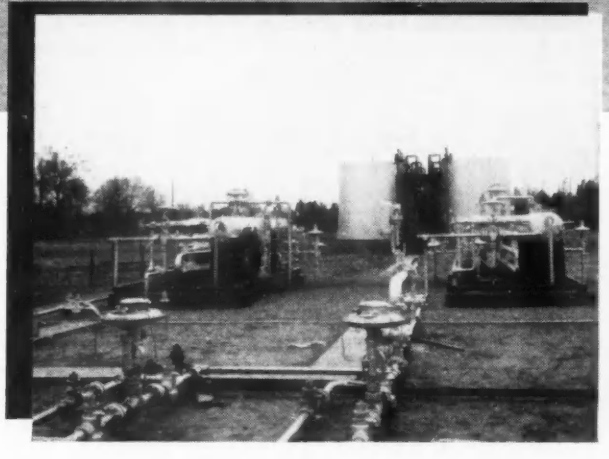

762 V. - 47 V. DROP - ALLOWED 70 VOLTS
880 V. - 34 V. DROP - ALLOWED 80 VOLTS
1320'
#1/0 ACSR
#1/0 ACSR
440' SPANS
1320'
#1/0 ACSR
#4/0 ACSR
RATED TRANSFORMER KVA / FULL LOAD KVA = .88
3-100 KVA TRANS.
#4 ACSR
PRIMARY #4 ACSR
SECONDARY #4/0 ACSR & #1/0 ACSR AS NOTED
1 SQ. MILE

Fig. 14—762-volt and 880-960-volt systems with 1 300-kva transformer bank and 16 25-hp motors with capacitors.





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always be connected on the line side of these relays.

In 762-volt operation, 460-volt single-phase capacitors, which can be used on a 440-volt system if desired, are connected in wye and the neutral grounded to the common grounding system. This stabilizes the effectiveness of the capacitors and prevents one capacitor's failure from damaging others. In an 880-volt system, capacitors are rated at 960 volts. It is recommended that these capacitors be single phase, as usually there are a few failures from time to time and it is approximately 2.6 times as costly to replace a three-phase capacitor as to replace one single-phase unit.

When capacitors are installed between the motor and the motor control, the circuit is protected by the motor control fuses. Where the capacitors are connected on the line side of the control and there are no line fuses, then fuses should be installed with the capacitors to protect the circuit.

First cost and power loss compared for two electrification systems

In two previous papers[1,4] presented by the author, economies between the 440-volt, 762-volt and 880-volt systems have been shown. The following is an analysis of first cost and power loss for two sets of electric pumping systems. Each system compares three methods of using a 440-volt utilization voltage and one method each for 762 and 880 volts. Wells are assumed for 40-acre spacing, which is common, and an area of one square mile is laid out.

In one set, Figures 7 through 10, and in Tables 1 and 2, 15-hp motors are assumed, and in the second set, Figures 11 through 14, and Tables 3 and 4, 25-hp motors are assumed.

Lines are run to the motors as directly as possible on 40-foot poles for the secondary and 45-foot poles for the primary. ACSR conductors are sized to pay out in less than five years any extra cost over a size that would give maximum allowable voltage drop. These layouts are hypothetical and regular, and in practice the cost per motor for an irregular layout could very easily be in favor of fewer transformer banks and the proposed higher voltages.

REFERENCES

[1] "762- Vs. 440-Volt Distribution Systems" by B. L. Moore, published in *Proceedings*, 29th Annual Meeting, American Petroleum Institute, Volume 29, Section IV, 1949.

[2] General Electric Distribution Data Book No. GET-1008-B, October 1948, pages 5 and 15.

[3] "A-C Motors for Oil Well Pumping" by M. H. Halderson, published in *Electrical Engineering*, July 1951, pages 598-601.

[4] "Higher Voltages Cut Electric Distribution Costs" by B. L. Moore, published in World Oil, August 1952, pages 209-220.

ACKNOWLEDGMENT

This paper originally presented in its entirety by the author before the American Institute of Electrical Engineers, Petroleum Industry Electrical Conference held September 27-29, 1954, at Tulsa, Okla.

Appendix and Table 4 on Page 213

TABLE 1

COMPARATIVE COST ANALYSIS OF ELECTRIC SYSTEMS FOR 16 WELLS ON 40-ACRE SPACING EQUIPPED WITH 15 HP, 1200 RPM, HIGH TORQUE, 3-5% SLIP MOTORS

ITEMS INCLUDED IN ELECTRIC SYSTEM	440-VOLT SYSTEM			762-Volt System Figure 10	880-Volt System Figure 10
	3 Tr. Banks Figure 7	4 Tr. Banks Figure 8	16 3-Phase Tr. Banks Figure 9		
Poles and hardware, plus installation	$ 3,097.00	$ 3,496.00	$ 3,590.00	$ 2,706.00	$ 2,706.00
Conductors and attachments, plus installation	3,603.00	2,267.00	2,341.00	3,320.00	3,320.00
Transformers and auxiliary material, plus installation	4,293.00	4,458.00	10,050.00	2,723.00	2,672.00
Motors, less installation	5,250.00	5,250.00	5,250.00	5,250.00	5,250.00
Controls and service material, plus installation, plus motor installation	6,997.00	6,997.00	5,152.00	7,374.00	7,725.00
	$23,240.00	$22,468.00	$26,383.00	$21,373.00	$21,673.00
Percent Cost	100 Percent	97 Percent	113 Percent	92 Percent	93 Percent

TABLE 2

COMPARATIVE COST ANALYSIS OF POWER LOSS FOR 16 WELLS ON 40-ACRE SPACING EQUIPPED WITH 15-HP MOTORS

Load Losses at 100 Percent Load—Watts	440-VOLT SYSTEM			762-Volt System 1 Tr. Bank Figure 10	880-Volt System 1 Tr. Bank Figure 10
	3 Tr. Banks Figure 7	4 Tr. Banks Figure 8	16 3-Phase Tr. Banks Figure 9		
Transformers	2,340	4,450	6,120	2,350	2,350
Distribution Lines	7,528	5,712	252	4,992	4,080
Services to Motors	1,520	1,520	1,070	730	544
Total Load Loss	11,388	11,682	7,442	8,072	6,974
Transformers No Load Loss	1,420	1,300	2,460	1,140	1,140
Grand Total	12,808	12,982	9,902	9,212	8,114

Total Load Loss Plus Transformer No Load Loss With Cost for Various Loads—Kilowatts

LOAD	440-Volt System						762-Volt System		880-Volt System	
	3 Tr. Banks Fig. 7	Cost/Year @1¢/KWH	4 Tr. Banks Fig. 8	Cost/Year @1¢/KWH	16 3-Phase Tr. Banks Fig. 9	Cost/Year @1¢/KWH	1 Tr. Bank Fig. 10	Cost/Year @1¢/KWH	1 Tr. Bank Fig. 10	Cost/Year @1¢/KWH
100 Percent	12.8	$1,112.00	13.0	$1,140.00	10.0	$875.00	9.2	$805.00	8.0	$700.00
90 Percent	10.8	1,031.00	10.8	1,031.00	8.5	745.00	7.6	665.00	6.8	595.00
80 Percent	8.7	760.00	8.8	770.00	7.3	640.00	6.3	550.00	5.6	490.00
70 Percent	7.0	614.00	7.0	614.00	6.2	542.00	5.0	437.00	4.5	394.00
60 Percent	5.5	481.00	5.5	482.00	5.2	455.00	4.0	350.00	3.6	314.00
50 Percent	4.0	350.00	4.1	360.00	4.2	358.00	3.1	272.00	2.8	245.00

TABLE 3

COMPARATIVE COST ANALYSIS OF ELECTRIC SYSTEMS FOR 16 WELLS ON 40-ACRE SPACING EQUIPPED WITH 25 HP, 1200 RPM, HIGH TORQUE, 3-5% SLIP MOTORS

ITEMS INCLUDED IN ELECTRIC SYSTEM	440-VOLT SYSTEM			762-Volt System Figure 14	880-Volt System Figure 14
	3 Tr. Banks Figure 11	4 Tr. Banks Figure 12	16 3-Phase Tr. Banks Figure 13		
Poles and hardware, plus installation	$ 3,097.00	$ 3,496.00	$ 3,590.00	$ 2,706.00	$ 2,706.00
Conductors and attachments, plus installation	4,269.00	3,081.00	2,341.00	5,010.00	5,010.00
Transformers and auxiliary material, plus installation	5,361.00	5,550.00	13,824.00	3,298.00	3,251.00
Motors, less installation	8,160.00	8,160.00	8,160.00	8,160.00	8,160.00
Controls and service material, plus installation, plus motor installation	8,209.00	8,209.00	5,784.00	7,945.00	7,985.00
	$29,096.00	$28,496.00	$33,699.00	$27,119.00	$27,112.00
Percent Cost	100 Percent	98 Percent	116 Percent	93 Percent	93 Percent

APPENDIX

I. Four times the load can be transmitted over the same conductors the same distance at 880 volts as at 440 volts without exceeding the allowable voltage drop. However, care must be exercised in order that the conductors not be overloaded. The power loss is four times greater than the loss at 440 volts; however, the power loss per kilowatt transmitted is the same as at 440 volts.

EXAMPLE: At 440 volts:
Wire size = No. 1/0 ACSR
Load = I = 50 amperes per leg of three-phase circuit
Length = D = 2200 feet of three-phase circuit
All calculations are based on an assumed power factor of 0.90.

Total volts drop equation = $\sqrt{3}$ ID

$$\left[\frac{R \cos \Theta}{1000} + \frac{X \sin \Theta}{1000}\right]$$

(From page 15, Ref. 2)
Where I = amperes per leg
D = length of 3-phase circuit
$\frac{R \cos \Theta}{1000}$ = resistance in ohms per 1000 feet at Θ degrees between voltage and current
$\frac{X \sin \Theta}{1000}$ = reactance in ohms per 1000 feet at Θ degrees between voltage and current
Resistance of No. 1/0 ACSR = 0.164 ohm per 1000 feet at 20° C.
Reactance of No. 1/0 ACSR = 0.119 ohm per 1000 feet at 60 cycles with equivalent conductor spacing of 24 inches.

Thus, total volts drop = $\sqrt{3}$ (50) (2200)

$$\left[\frac{(0.164)\ (0.90)}{1000} + \frac{(0.119)\ (0.436)}{1000}\right]$$

= $\sqrt{3}$ (50) (2.2) (0.1995) = 38.0 volts

At 880 volts:
If the load is increased four times, the amperes per leg of the 3-phase circuit = 4 $\left(\frac{50}{2}\right)$ = 100 amperes

The total volts drop = $\sqrt{3}$ (100) (2200)

$$\left[\frac{(0.164)\ (0.9)}{1000} + \frac{(0.119)\ (0.436)}{1000}\right]$$

= 76.0 volts

In this example, the I^2R loss per kilowatt transmitted at 880 volts is the same as at 440 volts.

Power loss = $3I^2R$
At 440 volts:
I = 50 amperes per leg

$$R = \frac{0.164}{1000}\ (2200) = 0.3608 \text{ ohm}$$

$3I^2R = 3(50)^2\ (0.3608) = 2706$ watts
At 880 volts:
If the load is increased by 4,

$$I = 4\left(\frac{50}{2}\right) = 100 \text{ amperes per leg}$$

$$R = \frac{0.164}{1000}\ (2200) = 0.3608 \text{ ohm}$$

$3I^2R = 3(100)^2\ (0.3608) = 10{,}824$ watts

Thus, when four times the load is transmitted the same distance at 880 volts as at 440 volts, the power loss is four times as much at 880 volts; however, the power loss per kilowatt transmitted is the same as at 440 volts.
At 440 volts:
Kilowatts transmitted = $\sqrt{3}$ (0.90) (440) (50) = 34.3 kilowatts. The power loss per kilowatt transmitted = $\frac{2.706}{34.3}$ = 0.0789 kilowatt

At 880 volts:
If load is increased four times,

$$I = 4\left(\frac{50}{2}\right) = 100 \text{ amperes}$$

Kilowatts transmitted = $\sqrt{3}$ (0.90) (880) (100) = 137 kilowatts
The power loss per kilowatt transmitted = $\frac{10.82}{137.0}$ = 0.0789 kilowatt

II. A given load can be transmitted over the same conductor four times the distance at 880 volts as at 440 volts without exceeding the allowable voltage drop. The power loss is the same for each voltage, but the power loss per kilowatt transmitted per unit distance is one-fourth as great for the 880-volt system as for the 440-volt system.

EXAMPLE:
Wire size = No. 1/0 ACSR
At 440 volts:
Length of 3-phase circuit = 2200 feet
Load = 50 amperes per leg of the circuit
Voltage drop = 38.0 volts, as shown before
At 880 volts:

$$\text{Amperes per leg} = \frac{50}{2} = 25 \text{ amperes}$$

Four times the length of 3-phase circuit = 8800 feet
Total volts drop = $\sqrt{3}$ (25) (8800)

$$\left[\frac{(0.164)\ (0.90)}{1000} + \frac{(0.119)\ (0.436)}{1000}\right] = 76.0 \text{ volts}$$

Power loss = $3\ I^2R$
At 440 volts:
Length of 3-phase circuit = 2200 feet
$3I^2R$ = 2706 watts, as shown before
At 880 volts:

$$I = \frac{50}{2} = 25 \text{ amperes per leg}$$

Length of 3-phase circuit = 8800 feet

$$3I^2R = 3(25)^2\left(\frac{0.164}{1000}\right)(8800) = 2706 \text{ watts}$$

Thus, when a given load is transmitted over the same conductors four times the distance at 880 volts as at 440 volts, the power loss is the same for each voltage.
At 440 volts:
Kilowatts transmitted = 34.3 kilowatts, as shown before
The power loss per kilowatt transmitted = 0.0789 kilowatt, as shown before
At 880 volts:
Kilowatts transmitted = $\sqrt{3}$ (0.90) (880) $\left(\frac{50}{2}\right)$ = 34.3 kilowatts. Inasmuch as this load is transmitted over the same conductors four times the distance at 880 volts as at 440 volts, the power loss per kilowatt per unit distance transmitted = $\frac{2.706}{4(34.3)}$

= 0.0197 kilowatt

III. The same load can be transmitted on one-fourth the conductor size the same distance at 880 volts as at 440 volts without the allowable voltage drop being exceeded. The power loss per kilowatt transmitted is the same at 880 volts as at 440 volts.

EXAMPLE:
At 440 volts:
Wire size = No. 1/0 ACSR = 105,592 circular mills
Length of 3-phase circuit = 2200 feet
Load = 50 amperes per leg
Voltage drop = 38.0 volts, as shown before
At 880 volts:

$$\text{Wire size} = \frac{105{,}592}{4} = 26{,}398 \text{ circular mills}$$

The nearest commercial size of No. 6 ACSR or 26,250 circular mills will be used in this example.
Length of 3-phase circuit = 2200 feet

$$\text{Load} = \frac{50}{2} = 25 \text{ amperes per leg}$$

Power factor is assumed to be 0.90
Resistance of No. 6 ACSR = 0.658 ohm per 1000 feet at 20° C.
Reactance of No. 6 ACSR = 0.136 ohm per 1000 feet at 60 cycles with equivalent conductor spacing of 24"
Total volts drop = $\sqrt{3}$ (25) (2200)

$$\left[\frac{(0.658)\ (0.90)}{1000} + \frac{(0.136)\ (0.436)}{1000}\right] = 62.0 \text{ volts}$$

It is to be noted that the actual reduction in wire size from No. 1/0 ACSR to No. 6 ACSR is the ratio of $\frac{105{,}592}{26{,}250} = 4.02$ to 1

The power loss at 440 volts = 2706 watts, as shown before
The power loss at 880 volts = $3I^2R = 3$

$$\left(\frac{50}{2}\right)^2\ \left[\frac{(0.658)\ (2200)}{1000}\right] = 2714 \text{ watts}$$

For the same load and the same distance, if the conductor size at 880 volts is one-fourth that at 440 volts, then the power loss per kilowatt is the same at 880 volts as at 440 volts.
The kilowatts transmitted = $\sqrt{3}$ (0.90) (V) (I)
At 440 volts:
Kilowatts transmitted = 34.3 kilowatts, as shown before
At 880 volts:
Kilowatts transmitted = $\sqrt{3}$ (0.90) (880) (25) = 34.3 kilowatts
The power loss per kilowatt transmitted at 440 volts is 0.0789 kilowatt, as shown before.
The power loss per kilowatt transmitted at 880 volts and with a wire size reduction of 4.02 to 1 ratio = $\frac{2.714}{34.3}$ = 0.0791 kilowatt

It is to be noted that the power loss per kilowatt transmitted would have been the same if a 4.0 to 1 reduction ratio had been used.

TABLE 4

COMPARATIVE COST ANALYSIS OF POWER LOSS FOR 16 WELLS ON 40-ACRE SPACING EQUIPPED WITH 25-HP MOTORS

Load Losses at 100 Percent Load—Watts	440-VOLT SYSTEM			762-Volt System	880-Volt System
	3 Tr. Banks Figure 11	4 Tr. Banks Figure 12	16 3-Phase Tr. Banks Figure 13	1 Tr. Bank Figure 14	1 Tr. Bank Figure 14
Transformers	5,530	5,750	4,900	4,650	4,650
Distribution Line	14,938	9,481	700	8,434	6,029
Services to Motor	1,450	1,450	1,970	1,470	932
Total Load Loss	21,918	16,681	7,570	14,554	11,611
Transformer No Load Loss	1,920	1,900	4,000	1,425	1,425
Grand Total	23,838	18,581	11,570	15,979	13,036

Total Load Loss Plus Transformer No Load Loss With Cost for Various Loads—Kilowatts

LOAD	440-Volt System						762-Volt System		880-Volt System	
	3 Tr. Banks Fig. 11	Cost/Year @1¢/KWH	4 Tr. Banks Fig. 12	Cost/Year @1¢/KWH	16 3-Phase Tr. Banks Fig. 13	Cost/Year @1¢/KWH	1 Tr. Bank Fig. 14	Cost/Year @1¢/KWH	1 Tr. Bank Fig. 14	Cost/Year @1¢/KWH
100 Percent	23.8	$2,080.00	18.6	$1,630.00	11.6	$1,020.00	15.9	$1,390.00	13.0	$1,140.00
90 Percent	19.7	1,720.00	15.4	1,350.00	10.1	880.00	13.1	1,150.00	10.7	1,030.00
80 Percent	16.6	1,450.00	12.6	1,110.00	8.8	770.00	10.7	1,030.00	8.8	770.00
70 Percent	12.6	1,100.00	10.0	875.00	7.7	675.00	8.5	745.00	7.1	620.00
60 Percent	9.4	822.00	7.9	690.00	6.7	585.00	6.6	578.00	5.6	490.00
50 Percent	7.4	646.00	6.0	525.00	5.9	516.00	5.0	438.00	4.3	376.00

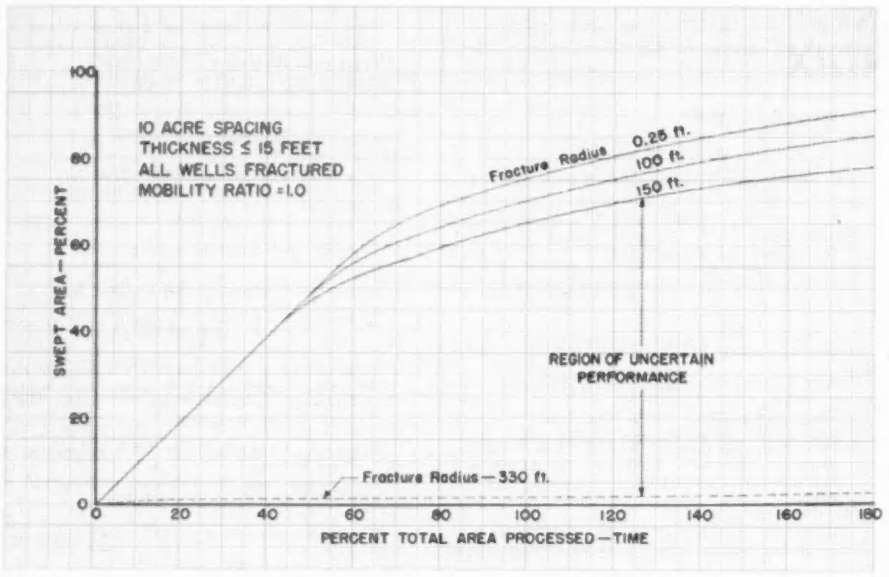


Fig. 1—Estimated performance of the line drive pattern in water-flooding and gas cycling horizontally-fractured thin reservoirs.

Water-flooding and gas cycling affected by . . .

Horizontal Fractures In Thin Reservoirs

Part 2: Line drive pattern.

By DR. PAUL B. CRAWFORD,
Texas Petroleum Research Committee, College Station, Texas

RESERVOIR FRACTURING techniques have led to considerable speculation on the effect such fractures may have on water-flooding or gas cycling possibilities. Primarily for this reason studies were made to obtain quantitative estimates of the effect circular horizontal fractures may have on the oil or distillate recovered at breakthrough and afterward for prolonged injection programs.

The circular horizontal fracture is sometimes termed a "pancake." This fracture originates at the well and extends as a circle out into the reservoir. The sand or propping agents are normally of such size that the permeability of the fracture is considerably greater than that of the reservoir matrix. Under such conditions it is desired to know what effect the fracture may have on water flooding or gas cycling results.

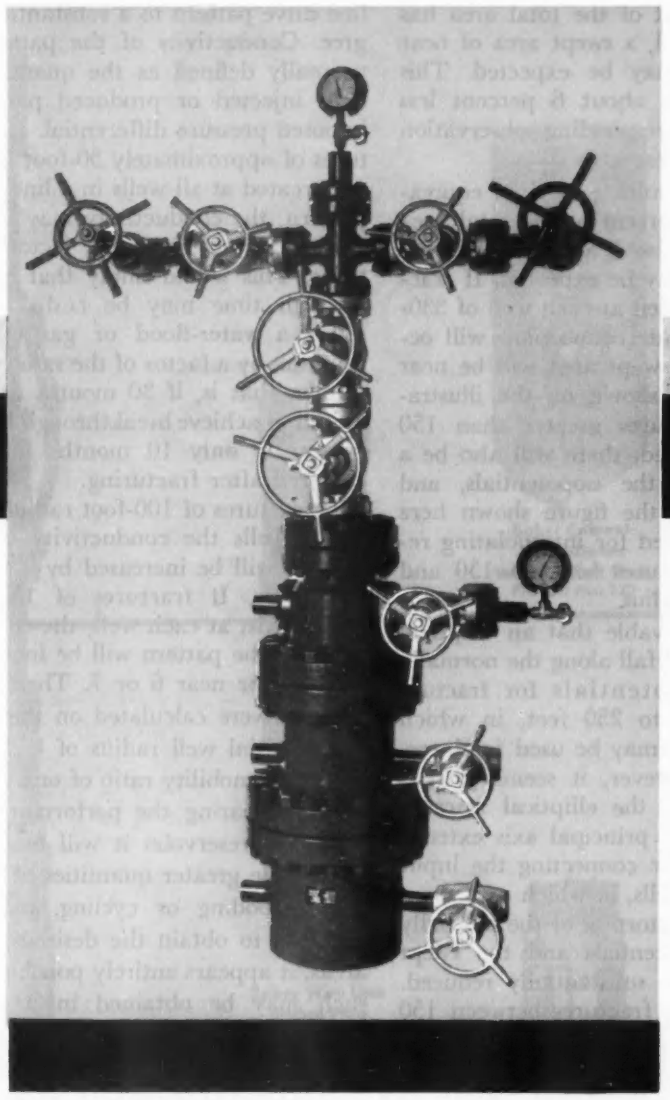
The problem. Muskat and Wyckoff,[3] and Hurst and Van Everdingen[2] presented the isopotentials for the line drive pattern. It will be noted in their work that the isopotentials about each well are substantially circular and exist as such for a considerable distance outward from the well.

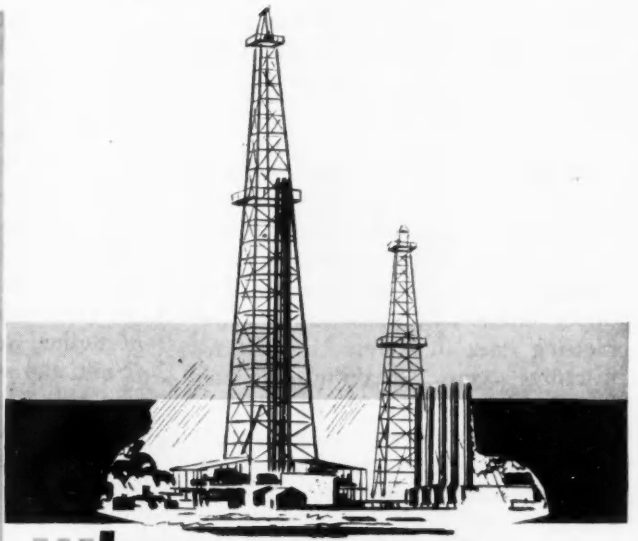
Consequently, in thin reservoirs the creation of a horizontal circular fracture of high permeability will have a negligible effect on the remaining isopotentials from the periphery of the fracture to the periphery of the opposite fractured well.

If the fracture is located along the bottom of the reservoir, potentiometric model studies have indicated that the principal distortion occurs only in the region immediately above the fracture. The effect of such is to reduce the potential gradient to approximately 0.01 of that which exists if no fracture were present. Consequently, the oil above or below a horizontal fracture will remain substantially in place during a fluid injection program; since it is implied that a pressure gradient of only 0.01 of the normal gradient will, for practical purposes, fail to produce oil at commercial rates.

It is indicated in these studies that if thin reservoirs have circular horizontal fractures the results may be estimated with a certain degree of precision from observations made on unfractured systems. The fluid recovery after breakthrough for several unfractured systems has been presented by Dyes, Caudle and Erickson.[1] They presented results for the case for the line drive and other patterns for mobility ratios ranging from near 0.1 to 10. The swept areas after breakthrough are shown here for the case of circular horizontal fractures existing at all wells in the line drive or square pattern. Data are limited to

This is the second of a series of articles discussing the influence of horizontal fractures on the secondary recovery of oil from thin reservoirs. Each article will discuss different phases of the problem, including performance and sweep efficiencies of the five-spot pattern, the line drive and the staggered line drive. This is the result of extensive research performed with potentiometric models and sponsored by the Texas Petroleum Research Committee, directed by Dr. George Fancher.





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thin reservoirs. A thin reservoir is defined as that in which the ratio of the thickness to the well spacing is equal to or less than 0.022.

Line drive performance. Figure 2 shows the water-flooding and gas cycling performance of horizontally fractured thin reservoirs. Data were calculated for a ten-acre spacing. The upper curve was obtained by cross plotting data in Reference 1. If no fractures occur, breakthrough may be expected to occur when 55.9 percent of the total area has been processed. After breakthrough, the swept area continues to increase as greater quantities of fluid are injected. When a volume of fluid equivalent to 100 percent of the total area has been processed, the swept area will be equal to 75 percent. When the volume of fluid corresponding to 140 percent of the total area has been processed, the swept area will be near 84 percent.

If circular horizontal fractures of 100-foot radius occur at all wells, breakthrough may be expected to occur when the volume of fluid equivalent to 49.0 percent of the total area has been processed. After breakthrough, the performance of the reservoir with the horizontal fracture is less efficient than that for the case in which no fracture exists.

When a volume of fluid equivalent to 100 percent of the total area has been processed, the swept area may be expected to be near 70 percent. This should be compared to the swept area of 75 percent when the same volume of fluid has been processed for the case in which no fracture occurs. When the volume of fluid equivalent to 140 percent of the total area has been processed, the swept area may be expected to be near 80 percent.

If circular horizontal fractures of 150-foot radius exist at all wells, breakthrough may be expected to occur when 41.5 percent of the total reservoir area has been processed. The displacement process is indicated to be less efficient as the radius of the fracture increases. When the volume of fluid equivalent to 100 percent of the total area has been processed where 150-foot fractures exist, a swept area of near 64 percent may be expected. This swept area is about 6 percent less than the corresponding observation for 100-foot fractures. When the volume of fluid equivalent to 140 percent of the total area has been processed, a swept area of near 64 percent may be expected. This swept area is about 6 percent less than the corresponding observation for 100-foot fractures.

When the volume of fluid equivalent to 140 percent of the total area has been processed, a swept area near 73 percent may be expected. If fractures are created at each well of 330-foot radius, interconnections will occur and the swept area will be near zero. This is shown on the illustration. If fractures greater than 150 feet are created, there will also be a distortion in the isopotentials, and consequently, the figure shown here can not be used for interpolating results for fractures between 150 and 330 feet in radius.

It is conceivable that an elliptical fracture could fall along the normally existing isopotentials for fracture radii of 200 to 250 feet, in which case Figure 1 may be used for interpolation. However, it seems just as probable that the elliptical fracture could have its principal axis extending on the line connecting the input and output wells, in which case there would be a distortion of the normally existing isopotentials and the swept area could be substantially reduced. Consequently, fractures between 150 and 330 feet in a ten-acre spacing are described as occurring in a region of uncertain performance. Unless the shape of the fracture is known, the swept area can not be determined with a high degree of precision.

Referring to Figure 2 it will be noted that the creation of circular horizontal fractures requires the processing of a greater quantity of the injected fluid to achieve the same swept area if no fracture had occurred. If it is desired to achieve a swept area of 60 percent, the quantities of fluid which must be handled for the case of no fracture, 100-foot fractures and 150-foot fractures are 62, 67 and 83 percent, respectively. If a swept area of 70 percent is to be achieved, the fluid processed must be equal to 81, 100 and 125 area percent, for the case of no fractures, 100 and 150-foot fractures, respectively. Similar comparisons may be made for other swept areas.

Pattern conductivity. Creation of circular horizontal fractures at each well increases the conductivity of the line drive pattern to a substantial degree. Conductivity of the pattern is normally defined as the quantity of fluid injected or produced per unit imposed pressure differential. If fractures of approximately 50-foot radius are created at all wells in a line drive pattern, the conductivity may be expected to increase by a factor near three. This would imply that breakthrough time may be reduced in either a water-flood or gas cycling program by a factor of the same magnitude; that is, if 30 months are required to achieve breakthrough before fracturing only 10 months may be required after fracturing.

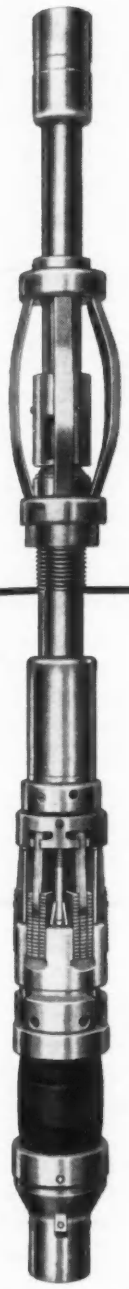
If fractures of 100-foot radius exist at all wells the conductivity of the pattern will be increased by a factor near four. If fractures of 150-foot radius exist at each well, the conductivity of the pattern will be increased by a factor near 6 or 7. These conclusions were calculated on the basis of an initial well radius of 0.25 feet and for a mobility ratio of one.

In comparing the performance of fractured reservoirs it will be noted that while greater quantities of fluid, either flooding or cycling, may be required to obtain the desired swept areas, it appears entirely possible that such may be obtained in a much shorter time after horizontally fracturing the reservoir. For example, if it is desired to achieve a 70 percent swept area for the line drive pattern, approximately 60 percent more fluid must be processed if 150-foot fractures occur than for the case if no fractures occur.

On the other hand, conductivity of the system with the 150-foot fracture is approximately six times as great. Consequently, it follows that the total quantity of fluid may be injected in approximately one-third the time that would be required to inject the required fluid if the wells were unfractured. The oil or distillate recovery would be approximately the same for the two cases.

For the case of 100-foot fractures, approximately 25 percent more fluid would have to be processed than for the case in which no fractures exist. The 100-foot fractures produce an increase in conductivity by a factor near four. Consequently, the addi-

Continued on Page 224



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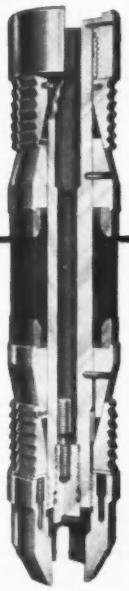

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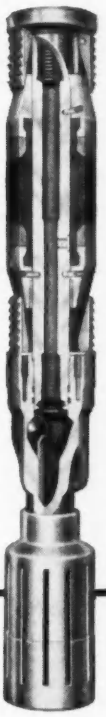

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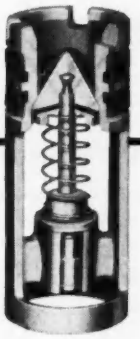

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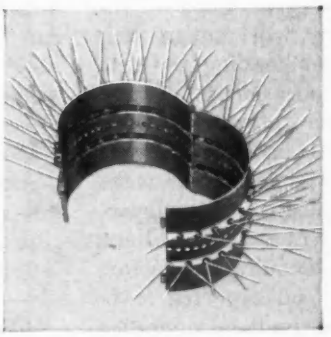

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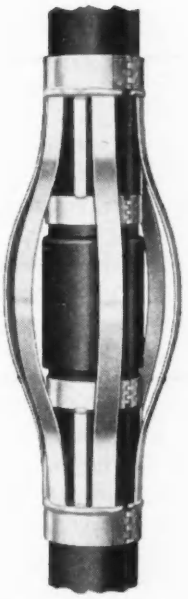

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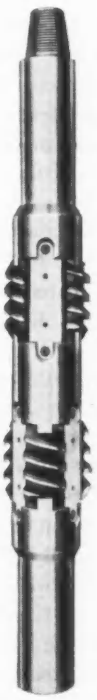

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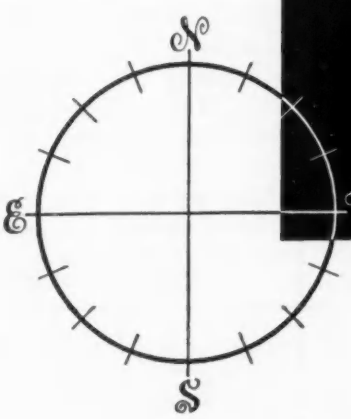

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Evaluating the Water-Flood Possibilities of a Lease

Here are some good and bad points to consider. Some steps to take in planning a flood and how to calculate approximate recoveries.

By C. H. KEPLINGER and J. M. WANENMACHER,
Consulting Petroleum Engineers, Tulsa

In order to satisfy the requirements for a successful water-flood operation, the following conditions must be fulfilled:

- An adequate source of water must be assured.
- There must be an understanding with owners of other leases to the effect that they will unitize their leases for water-flooding or with owners of the adjacent leases that they will cooperate in the drilling of injection wells on lease lines and injection of water into these wells.
- The reservoir must contain substantial amounts of recoverable oil and be amenable to flooding with water.
- The amount of oil expected to be recovered from the flood operation and the income which will result must be sufficient to yield a satisfactory profit after the cost of development, the expense of operation and the cost of lease acquisition, if any.

In general, flood operations are confined to reservoirs which have produced by gas-drive. This type of reservoir drive leaves a large portion of oil in the reservoir. On the other hand, reservoirs which have produced by an active water drive leave little or no oil to be recovered by water-flood. Certain reservoirs of the gas-drive type suffer so much depletion by gravity drainage that water-flooding is not feasible.

The reservoirs most amenable to flooding with water are those which are continuous and uniform. Uniformity of permeability is particularly desirable. Reservoirs with extreme variation in permeability do not respond to flooding.

Unfavorable Factors. With this in mind the following types of reservoirs can be classed as generally unfavorable:

- Reservoirs with abundant natural crevices and fractures.
- Limestones with vugular type porosity.
- Reservoirs which have been subjected to large or repeated fracture treatments.

The presence of gas-caps makes flooding difficult, because water passes through the gas sands more readily than through oil sands.

Reservoirs with oils of high viscosity are considered unfavorable. Most engineers do not consider reservoirs favorable for flooding if the viscosity of the oil exceeds 50 centipoises. Water tends to break through such reservoirs and leave large amounts of oil behind.

Extremely shallow reservoirs are also difficult to flood, because application of even moderate amounts of pressure necessary to cause movement of oil may lift the overburden and allow channeling of water.

Flood Recoveries. If the property merits further investigation after consideration of the above factors, some thought should be given to the possible recoveries from water flooding. In most floods the secondary recovery commonly equals or slightly exceeds the primary recovery. Thus, if the primary recovery has been substantial the recovery from water-flood indicated by this rule of thumb will probably be sufficient to justify a more detailed investigation. If core data are available, even in small amounts, they may provide a basis for estimates of secondary recovery.

The detailed investigation should include assembly and study of all available information including production records, well logs and records, electric logs, core data, etc. Unfortunately, most of the properties which are now being considered for water-flood were developed many years ago, and little information is available other than production records and drillers' logs.

Reservoir Investigation. It is highly desirable to construct numerous cross-sections showing the lithology of the producing formation in detail, the intervals where oil and gas were reported by the driller, the total depth, plugged back depth, producing intervals, and other information. If electric logs, drill stem tests, etc., are available they should be shown on the cross-section.

After construction, the cross-section should be correlated carefully. Lithologic correlations within the producing formation may reveal the degree of continuity of the productive portions of the reservoir rock. A study of the fluid content reported by the drillers may enable establishment of oil-water contacts and gas-caps. The correlated cross-sections provide an excellent basis for construction of structure maps and isopach maps.

Core Data Desirable. A careful study should be made of the production records on a well basis if records of individual wells are available. These studies may reveal accidental water-floods which if extensive may have eliminated to a large extent the secondary recovery possibilities of the property. A study should be made of water production. In the case of older properties, records of water production are usually not available, but often some information of this nature can be obtained from the lease personnel.

If no core data are available and the investigation at this state indicates

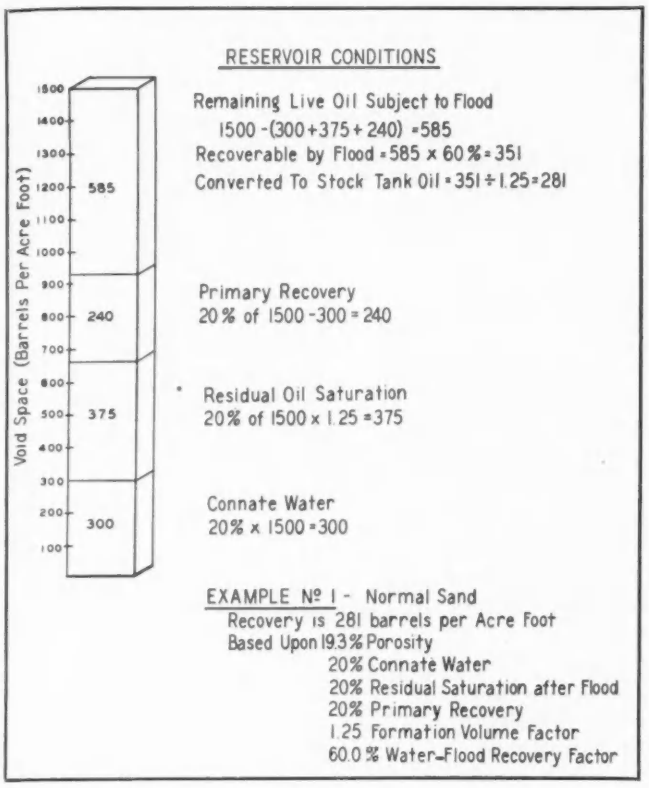
RESERVOIR CONDITIONS
Void Space (Barrels Per Acre Foot)
585
240
375
300
Remaining Live Oil Subject to Flood
1500 -(300+375+240) =585
Recoverable by Flood =585 x 60% = 351
Converted To Stock Tank Oil = 351 ÷ 1.25 = 281
Primary Recovery
20% of 1500 -300 = 240
Residual Oil Saturation
20% of 1500 x 1.25 =375
Connate Water
20% x 1500 =300
EXAMPLE Nº 1 - Normal Sand
Recovery is 281 barrels per Acre Foot
Based Upon 19.3% Porosity
20% Connate Water
20% Residual Saturation after Flood
20% Primary Recovery
1.25 Formation Volume Factor
60.0% Water-Flood Recovery Factor

FIGURE 1

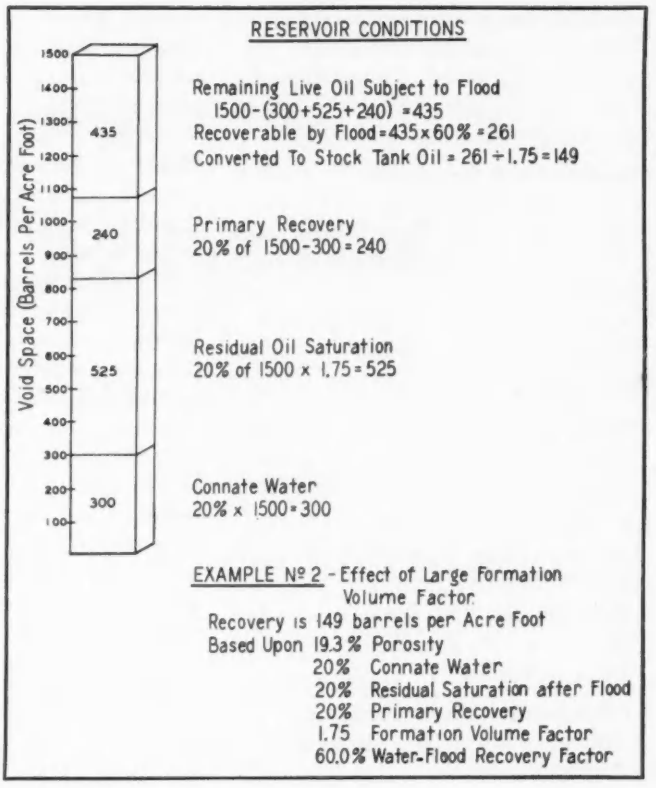
RESERVOIR CONDITIONS
Void Space (Barrels Per Acre Foot)
435
240
525
300
Remaining Live Oil Subject to Flood
1500-(300+525+240) =435
Recoverable by Flood=435x60% =261
Converted To Stock Tank Oil = 261÷1.75 = 149
Primary Recovery
20% of 1500-300 = 240
Residual Oil Saturation
20% of 1500 x 1.75 = 525
Connate Water
20% x 1500 = 300
EXAMPLE Nº 2 - Effect of Large Formation Volume Factor
Recovery is 149 barrels per Acre Foot
Based Upon 19.3% Porosity
20% Connate Water
20% Residual Saturation after Flood
20% Primary Recovery
1.75 Formation Volume Factor
60.0% Water-Flood Recovery Factor

FIGURE 2

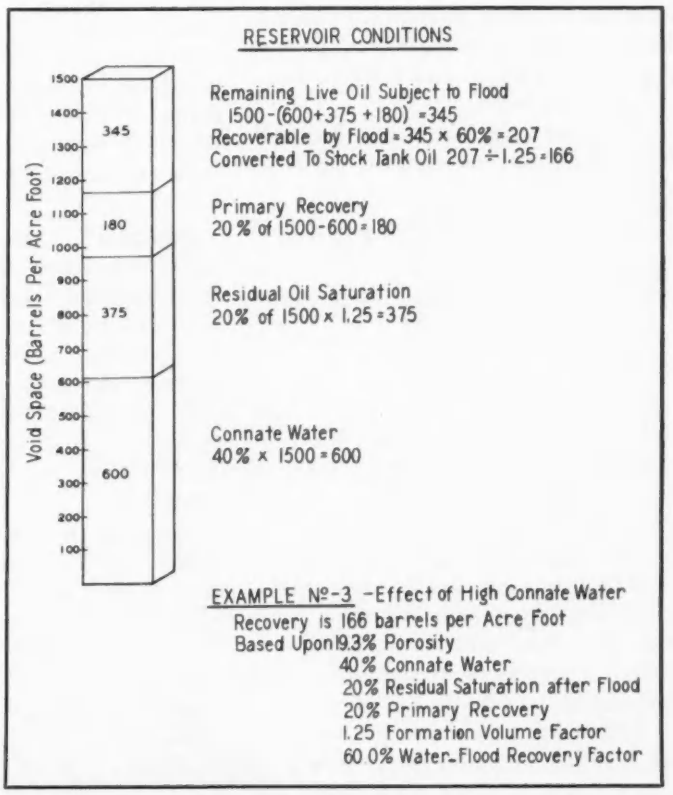
RESERVOIR CONDITIONS
Void Space (Barrels Per Acre Foot)
345
180
375
600
Remaining Live Oil Subject to Flood
1500-(600+375+180) =345
Recoverable by Flood = 345 x 60% = 207
Converted To Stock Tank Oil 207 ÷ 1.25 = 166
Primary Recovery
20% of 1500-600 = 180
Residual Oil Saturation
20% of 1500 x 1.25 = 375
Connate Water
40% x 1500 = 600
EXAMPLE Nº-3 -Effect of High Connate Water
Recovery is 166 barrels per Acre Foot
Based Upon 19.3% Porosity
40% Connate Water
20% Residual Saturation after Flood
20% Primary Recovery
1.25 Formation Volume Factor
60.0% Water-Flood Recovery Factor

FIGURE 3

that flooding probably will be profitable, it is common practice to drill several core holes. These usually are drilled at locations where they can later be used as injection wells. The cores are analyzed in the laboratory to determine porosity, permeability, oil saturation and water saturation. Flood pot tests are run to determine residual oil saturation. Tests made with fresh water and field brines indicates which is the better flooding medium.

If the core data indicate a favorable recovery the flooding operations may be commenced. It is common practice to flood only a small area at first and enlarge the operations if this proves successful.

In instances where the producing formation is moderately deep, the cost of drilling core holes is usually so large that no coring is done, and a pilot flood is started utilizing present producing wells for water injection.

In other instances where the formation to be flooded has responded satisfactorily on nearby properties and the core data indicate a satisfactory recovery, a pilot flood may not be necessary.

Estimating Flood Recovery. Mathematical calculations of recovery by flooding with water can be made if the following reservoir information is available.[1]

- **Volume of Permeable Oil Sand.** This is usually calculated from isopach maps.
- **Porosity of the Reservoir.** Values of porosity are commonly determined by analyses of cores.
- **Permeability of the Reservoir.** Permeability of the reservoir is also commonly determined by analyses of cores.
- **Connate Water Content.** This is best determined by analyses of cores taken with cable tools or electro drill using oil as the drilling

fluid. Measurements of rotary cores taken with oil-base mud are also considered reliable. Determinations are also made from electric logs or by the restored state methods.

- **Residual Oil Saturation.** This value is commonly determined by flood pot tests of cores. The oil saturation of cores taken at moderate or great depths by rotary using water-base muds commonly approximates the residual oil saturation.
- **Primary Oil Recovery.**
- **Relative Permeability to Oil and Water.** This is also a laboratory determination.
- **Formation Volume Factor.** The formation volume factor is determined by PVT analysis of the reservoir fluid. It may be estimated rather accurately if the original gas-oil ratio is known.
- **Oil Viscosity Under Reservoir Conditions.** This is also a laboratory determination.

The calculation is not simple and the necessary data are seldom available. As in other branches of petroleum engineering, the client or the management expects an estimate from the data available.

A formula used by many engineers for calculating water-flood recovery follows:

$$Rw = E(7758 \times P \times 1 - [Cw \text{ plus } (Or \times FVF)] - (Rp \times FVF)$$

Where

Rw = Recovery by water flood in barrels per acre foot
E = Sweep Efficiency
7758 = Barrels per acre foot
P = Porosity (as a decimal)
Cw = Connate Water (as a decimal)
Or = Residual Oil Saturation (as a decimal)
Rp = Primary Recovery (barrels per acre foot)
FVF = Original Formation Volume Factor

The sweep efficiency (E) is the recovery factor for the flooding operation. The theoretical efficiency for a five-spot flood with uniform sand is 70 to 75 percent. Variations in vertical permeability cause the loss of oil which is left in less permeable portions due to flooding out more permeable portions and a resulting high water cut. This loss due to vertical variation in permeability can be calculated by means of permeability distribution curves and the Ko/Kw relationship.[2]

The vertical sweep efficiency commonly lowers the flood recovery factor to about 60 percent. If the spacing pattern is not uniform, and this frequently results when old wells are used, the flood recovery factor may be further reduced to between 50 to 55 percent.

Effect of Factors Involved. Variations in some of the factors used in the above equation can result in some rather surprising answers.

The effect of some of these factors upon the water-flood recovery is illustrated by three calculations. In each instance the assumed porosity is 1500 barrels of voids per acre foot, a value which corresponds to 19.3 percent porosity and is representative of many of the sands now being flooded. Residual oil saturation of 20 percent, a water-flood recovery factor of 60 percent and a primary recovery factor of 20 percent, which are also typical values, have been assumed.

The purpose here is to illustrate the effect of high connate water content and the effect of a large formation factor (high shrinkage) as compared to average values.

Example 1. This calculation (Figure 1) is for a sand with a connate water content of 20 percent and a formation volume factor of 1.25. This is typical of average reservoirs at depths of 3000 to 4000 feet. The calculation (Figure 1) results in a water-flood recovery of 281 barrels per acre foot.

Example 2. This calculation (Figure 2) is for a reservoir of similar characteristics except that the formation volume factor is 1.75 and results in a water flood recovery of 149 barrels per acre foot. The higher formation volume factor which corresponds to many reservoirs at depths of 6000 to 7000 feet, causes a much smaller recovery.

Example 3. This calculation (Figure 3) is for a reservoir similar to that in Example 1 except that the connate water content is 40 percent. The calculated recovery is 166 barrels per acre foot. This illustrates why sands with high saturations of interstitial water are less attractive for flooding. —**The End**

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[1] Dykstra, Herman and Parson, R. L., "Prediction of Oil Recovery by Water-Flooding," page 160, Secondary Recovery of Oil in the United States, 2nd Edition, API, 1950.

[2] Stiles, W. E., "Use of Permeability Distribution in Water-Flood Calculations," Page 9, Transactions AIME, 1949.

ACKNOWLEDGMENT

This article is based upon a talk given at the North Texas Section, AIME meeting at Wichita Falls, Texas, Jan. 13, 1954, and is presented here with the permission of the authors.

Horizontal Fractures

Continued from Page 216

tional quantity of fluid could perhaps also be injected in a much shorter time than would be required to inject the desired fluid where no fractures exist. Similar comparisons may be made for other swept areas.

Conclusions. If fractures occur at each well, breakthrough will occur in a shorter time than if no fractures had existed. Swept areas will be reduced as the fracture radius is increased. If no fractures occur, the swept area at breakthrough is estimated to be near 55.9 percent. If fractures of 100 or 150-foot radius occur, the swept areas at breakthrough are estimated to be near 49.0 and 41.5 percent, respectively.

In order to achieve the same swept area, greater quantities of fluid must be injected if horizontal fractures occur than for the case if no fractures occur. However, it is also pointed out that the creation of circular horizontal fractures results in a substantial increase in the pattern conductivity. Such increases may be near three to six fold. Under such conditions it appears that water-flooding or gas cycling programs in fractured reservoirs may be conducted in a much faster manner, and that large swept areas may be achieved in a much shorter time than would be obtained if no fractures had occurred.

For the ten-acre spacing, creation of fractures larger than 150 feet in radii may be expected to produce erratic results. This is due to the distortions in normally existing isopotentials, and the possibility of fracture interconnections. For the latter case, the swept area may be near zero. It is suggested that prior to the initiation of a water-flooding or gas cycling program studies be made to determine the nature and extent of the fractures. If they appear to be in an unfavorable range, remedial action should be considered.

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[2] Hurst, W., and Van Everdingen, A. F., "Performance of Distillate Reservoirs in Gas Cycling," AIME Trans., Vol. 165, P. 36 (1946).

[3] Muskat, M., and Wyckoff, R. D., "A Theoretical Analysis of Water Flooding Networks," AIME Trans., Vol. 107, P. 62 (1934).

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LANDSLIDE IN VENTURA AVENUE FIELD of California. Surface of slide, comprising about 160 acres, has been contoured and oiled as shown by dark appearance.

How Landslide Was Controlled at Ventura

The surface was oiled and water drained from the affected area.

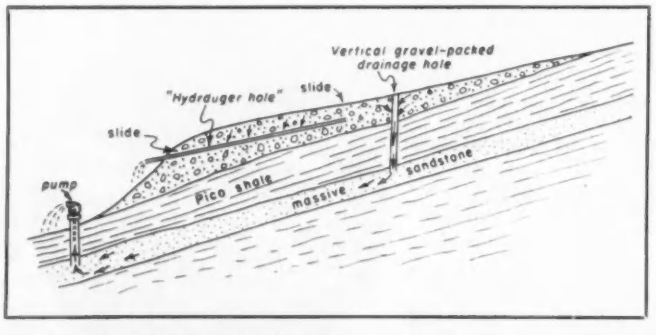
THE VENTURA AVENUE oil field is the second largest current source of oil in California. There are over 900 wells in this field and the present production amounts to about 84,000 barrels daily. More than 448 million barrels of oil had been produced to January 1, 1953.

Because of extensive landslides, common on the steep topography within this oil field, a large number of wells have been damaged or totally ruined. Elaborate protective measures are now being used to safeguard wells in or adjacent to these areas. These efforts are concentrated on minimizing water percolation into the slides, and on removal of water contained in the slides.

Several hundred nearly horizontal "hydrauger" holes, totaling more than 40 miles in length, have been drilled in the sides to remove water from them. The most evident measure taken to minimize water percolation is the stripping of vegetation from the sliding ground. Some slides are covered with oiled surfaces which extend over as much as 160 acres. Some of them on the east side of Ventura Avenue can be seen from the highway. Wells were damaged by landsliding movement as long ago as 1926, and old topographic maps show that some of the slides were in existence long before the oil field was discovered.

Especially severe damage to wells was caused by landsliding during the winter of 1941-42. In one eight-hour period a slide extending over an area of 60 acres moved 100 feet. Twenty-three wells either were sheared off beneath this slide or were so much distorted that their casing was badly bent and production was cut off. All of the wells were later restored to production by digging vertical shafts 25 to 130 feet through the slide to reach the cutoff parts of the holes. A massive sandstone bed below the slide-plane is now utilized as an aquifer into which water is drained by drilling vertical holes through the slide. Additional "hydrauger" holes were drilled into the slide in a nearly horizontal position to further drain the mass, and the surface of the slide was scraped and oiled.

All these precautions can only keep movement to a minimum and widen the time interval between major slips. Recent movements in the slides of the Ventura Avenue oil fields are considered to be confined mostly to their upper parts and the continual work on combating these vast areas of sliding ground is considered to be successful. The precautions taken demonstrate the importance of detailed geologic study to guide the installation of corrective water drainage devices.



METHOD OF DRAINING water in landslide is shown in this schematic diagram. Massive sandstone layer beneath slide is used.

ACKNOWLEDGMENT

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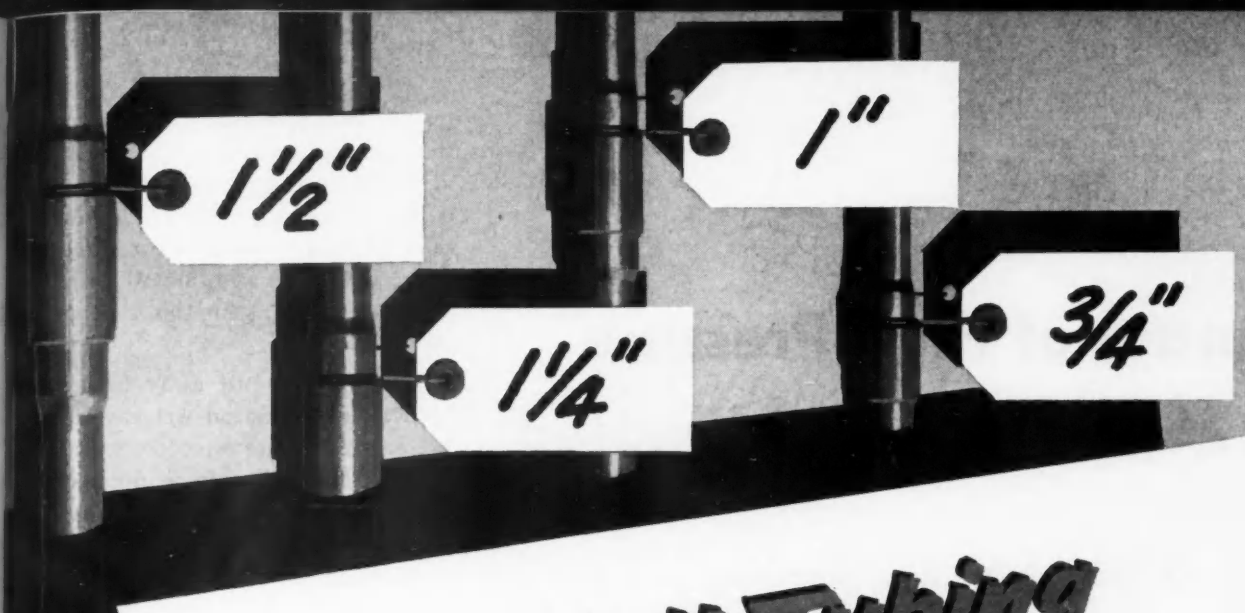
—The End



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Accuracy of High-Pressure Gas Measurement Increased

• Intermitting flow, pulsations, and flow line installations cause problems.

• Here's how to overcome them.

By W. A. ROCK, Branch Manager,
The Foxboro Company, Corpus Christi, Texas

HIGH-PRESSURE GAS measurement practices as they pertain to field production operations fall into three classifications: (1) flow line installations, (2) intermitting flow problems, and, (3) pulsating flow problems. High pressures are defined here as being working pressures above 2000 pounds per square inch gauge.

Retrograde condensation contributes much to wet gas measurement problems at high pressure. When the pressure drop is taken at the well, it is particularly important to see that the meter run is properly installed. It is recommended that the meter run, orifice fitting, and meter be of a pressure rating sufficient to withstand the shut-in well pressure, and that the regulating choke be installed downstream of the meter run. This means that the gas will be measured at high pressure, while it is still quite warm.

A bottom-hole choke or a positive choke should be installed in the christmas tree for safety, and the meter and flange enclosed in a meter house that will permit continuous operation in cold weather. Generally there is enough heat from the flow line to prevent hydrate formation. A small inexpensive meter house is usually sufficient to utilize this heat. Since most freezing occurs in the lead lines between the meter and orifice fitting, the lead lines should be kept as short as possible, and the fitting shut-off valves should be of the straight-through types.

For years meter manufacturers have recommended the use of lead lines of at least ½-inch diameter, but because of installation difficulties, this recommendation has not always been followed. However, the use of ⅜-inch outside diameter steel tubing, properly installed, has given excellent results. Improper piping results when the horizontal meter run is installed at too high an elevation. If the run is kept at a lower elevation, it is possible to install the meter directly above the flange with almost vertical piping and still keep this piping as short as possible.

There is a trend away from the vertical meter run on wet gas measurements. The use of eccentric bored orifice plates will gain in popularity when coefficients for them are available from the American Gas Association. When a liquid level forms on the upstream side of the orifice plate, the effective line size is changed.

Unfortunately, even the best installation, properly engineered and designed, will not alone insure accurate measurement. A regular inspection program must be set up and adhered to. The pumpers or operators should be given supervised discussion periods, during which troubles and procedures can be thoroughly explained.

Multi-well hookups. Field cooperation also is essential to good measurement, and the use of automatic control, properly applied, can assist toward this end. For example, some producers are using large size, low-temperature separation units with multiple well manifolds to reduce installation costs. Figure 1 shows a typ-

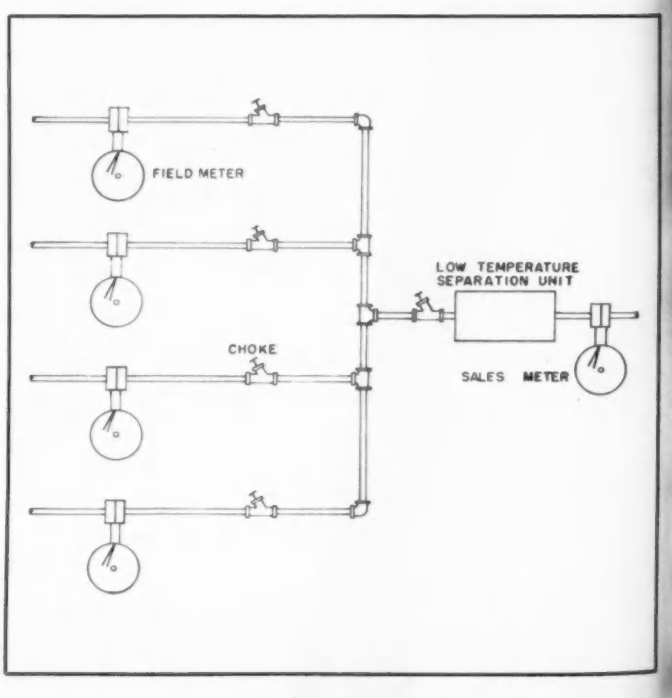
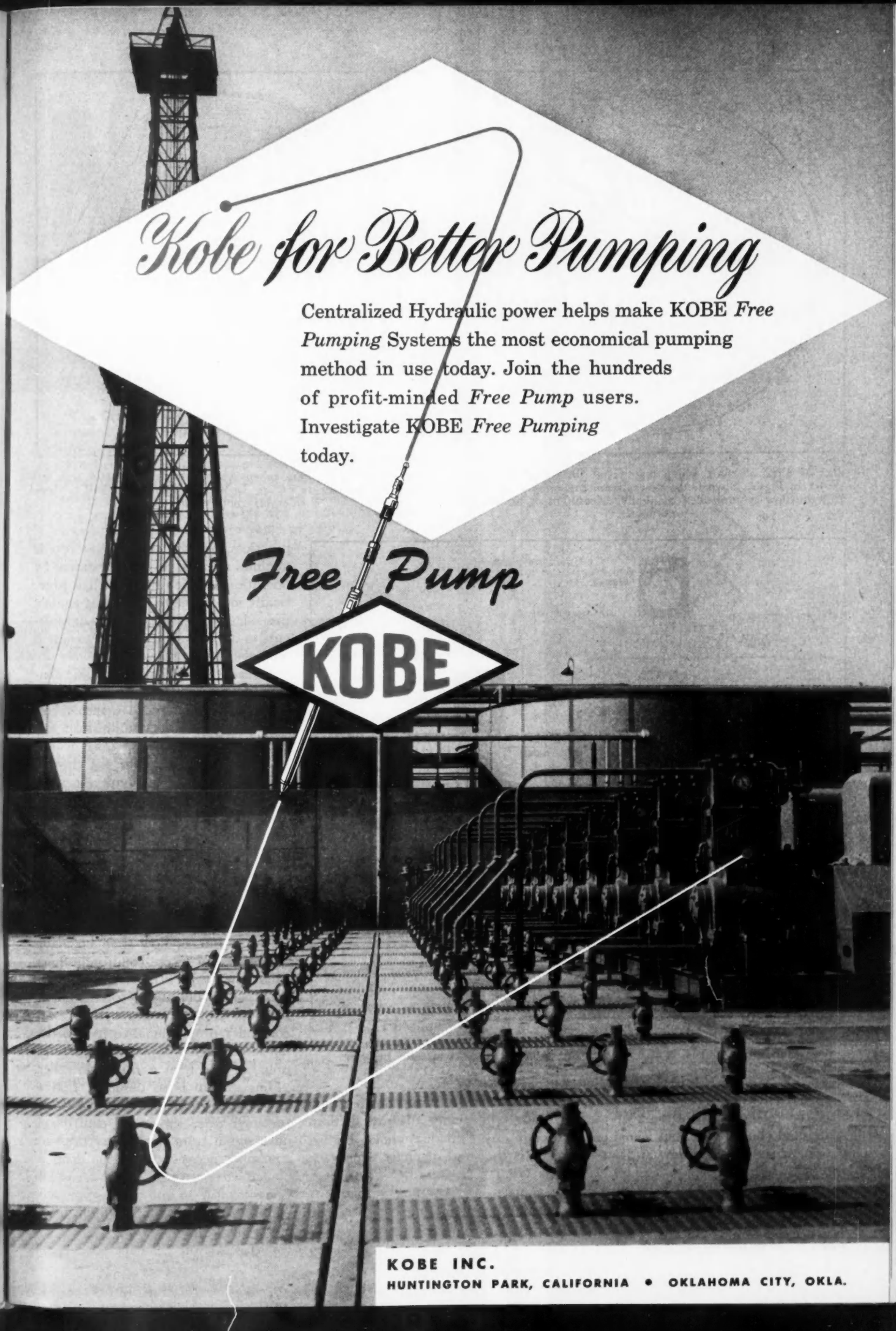


Fig. 1—Typical installation where one large separation unit serves several wells. Note that the meters are upstream of the flow line chokes.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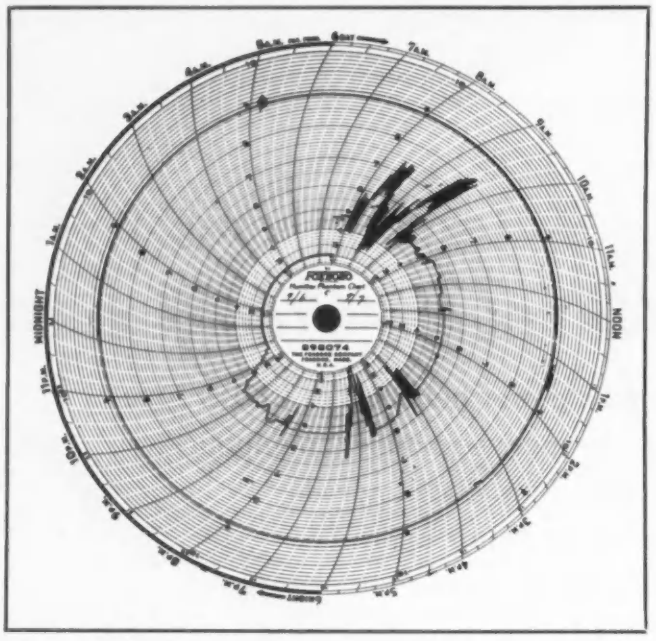

Fig. 2—Type of chart which may result for an installation as shown in Figure 1 when the downstream pressure varies widely and the flow is controlled manually. Measurement accuracy is dubious.

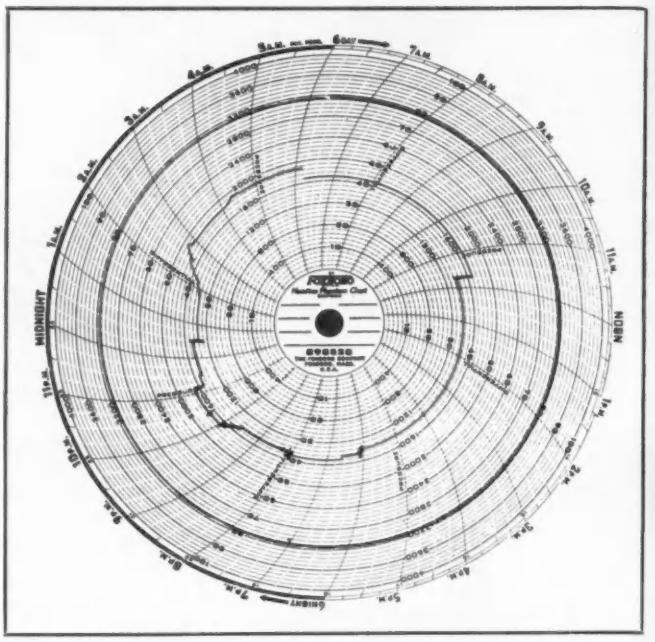

Fig. 4—Typical chart taken when automatic control was applied to the case in Figure 1. Volumes computed will be considerably more accurate.

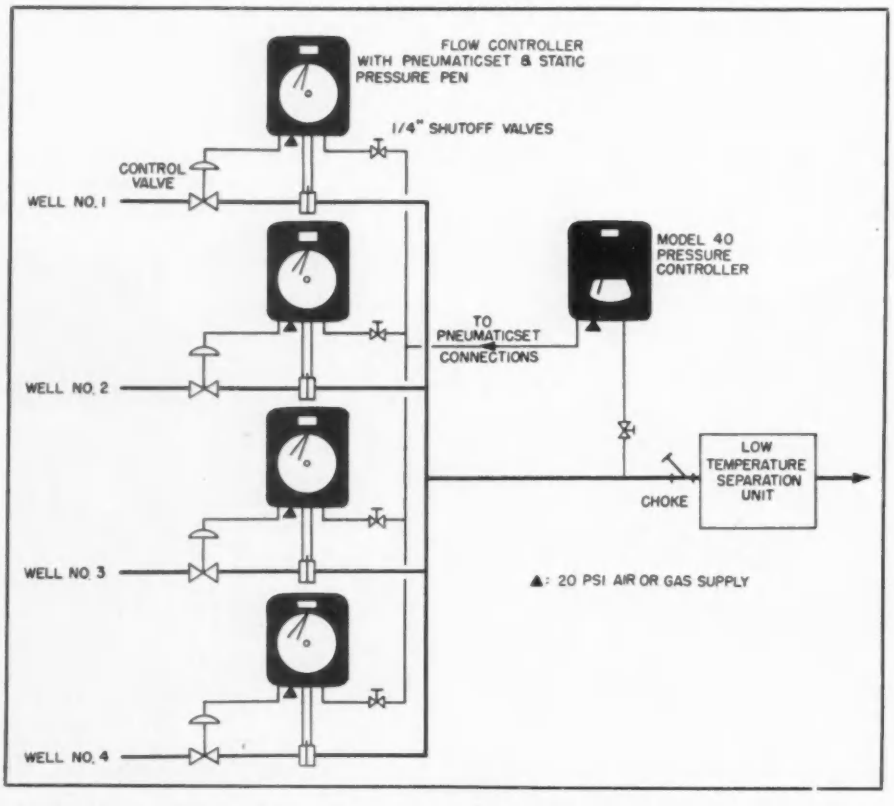

Fig. 3—Automatic control was applied to the installation of Figure 1 to eliminate the measurement problem. Note that each orifice meter operates at same pressure.

ical installation of this kind. Note that the meters are upstream of the individual chokes, and that a manual choke controls the gas flow and pressure drop into the separation unit.

The pressure drop across the individual chokes is not critical. However, any change in the downstream pressure will change the rate of flow through any individual choke. Figure 2 shows the kind of chart which results from such control. The meter installation was properly made in accordance with good measurement practices, but the chart readability is at times reduced to such an extent by operational difficulties, that it is practically impossible to balance it against the sales meter. This makes it difficult to apportion royalty payments if several leases are involved.

Figure 3 shows how automatic control was used to eliminate these difficulties. Note that each orifice meter is operating at the same pressure. For good control in installations of this kind, it is necessary for the flowing wells to operate at about the same pressure, and for the pressure on the header to be about ten to fifteen pounds lower than the flowing pressure of the weakest well.

Note that each well stream is regulated by a separate flow controller, and that the pressure controller on the header signals each flow controller what rate of flow shall be maintained for a given condition. Since each flow controller has an adjustment which permits it to respond to a signal from the master pressure controller proportional to its individual setting, each flow controller functions, in effect, as a ratio controller.

The system is so designed that if any well or wells fail to flow at the specified rate, the other controllers, on a signal from the master pressure controller occasioned by the drop in controlled pressure, will increase in correct ratio to make up the deficiency. This hookup permits mini-

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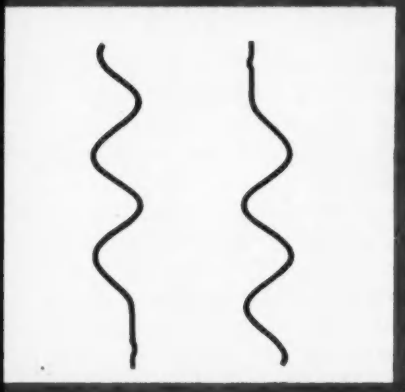


BYFLOW — WASHING ACTION

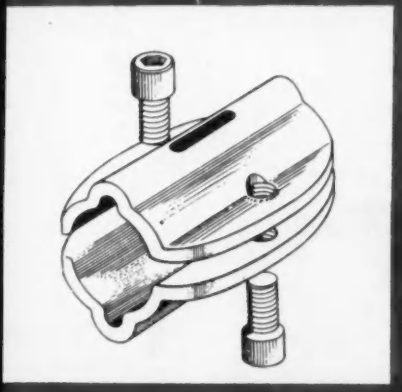
Coiled to measure ¼" diameter less than the i.d. of the tubing, the spiral allows ample clearance for running and pulling rods. Fluid flows freely through spirals. During the downstroke, spirals agitate standing well fluid, setting up a washing action which completely keeps paraffin from balling up on spirals and the paraffin fully homogenized and on the move, keeping the tool as well as the tubing clean.

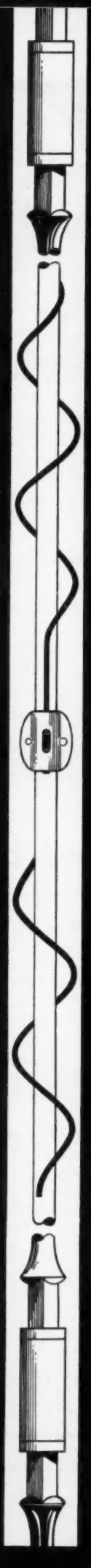
CLAMP-INSTALLATION

The clamp is a die stamping of identical halves of heavy material. There are no right- or left-hand parts. Any two pieces form a complete clamp.

Clamps attach to the sucker rod by socket cap screws heat treated for tensile strength of 54,000 p.s.i. Thread holes are extruded to give maximum thread area. A preloaded 1/16" standoff between clamp halves prevents slipping when rods stretch in the hole.

A dimple on the straight shank of the spiral which fits into a 9/16" slot punched into the clamp body keeps spirals intact.





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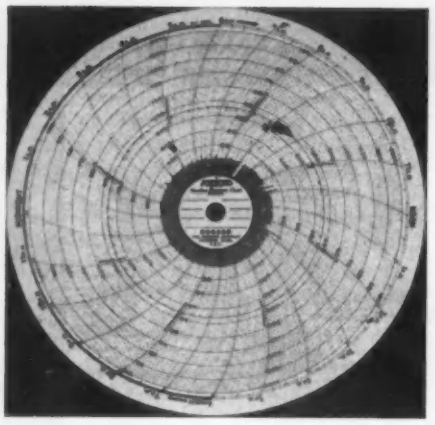

FIGURE 5A

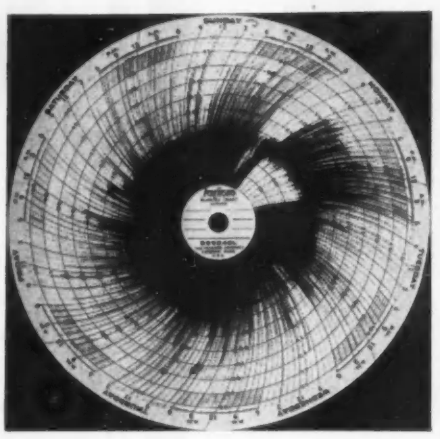

FIGURE 5B

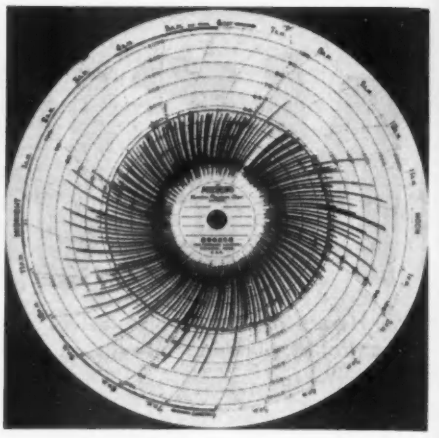

FIGURE 5C

Use of the conventional orifice meter hookup and a daily chart produces undesirable records like this in measuring intermitting gas lift wells.

mum and maximum flow rates to be established for wells having limited flowing characteristics, and allows strong wells to take the swing in operating loads.

In operation it is simple. All that is necessary is to change the opening of the choke at the low temperature separation unit. By manipulating this one choke, flow can be increased, decreased or all wells shut-in. No other operation is required. Figure 4 shows a typical chart from this type of operation.

Temperature important. For years, no effort has been made by many field operators to measure accurately the gas of individual wells. Usually, there is an indicating thermometer in the meter run, but it is only read once a day or once a week, as the case may be, and an average worked out at the end of the chart reading period. However, several installations have been observed where the temperature of the flowing gas changed as much as 50 degrees when the rate of flow was changed.

Since a more accurate measurement is essential, there are two ways of handling this problem. One way is to use a meter with three pens, one to measure pressure, one differential, and one temperature. These records are all on the same chart, eliminating duplication and reducing chart expense. If it is inconvenient to send an installed meter back to the manufacturer to have a temperature element added, a separate mounted temperature recorder can be used.

Measurement hints for high-pressure flow line hookups . . .

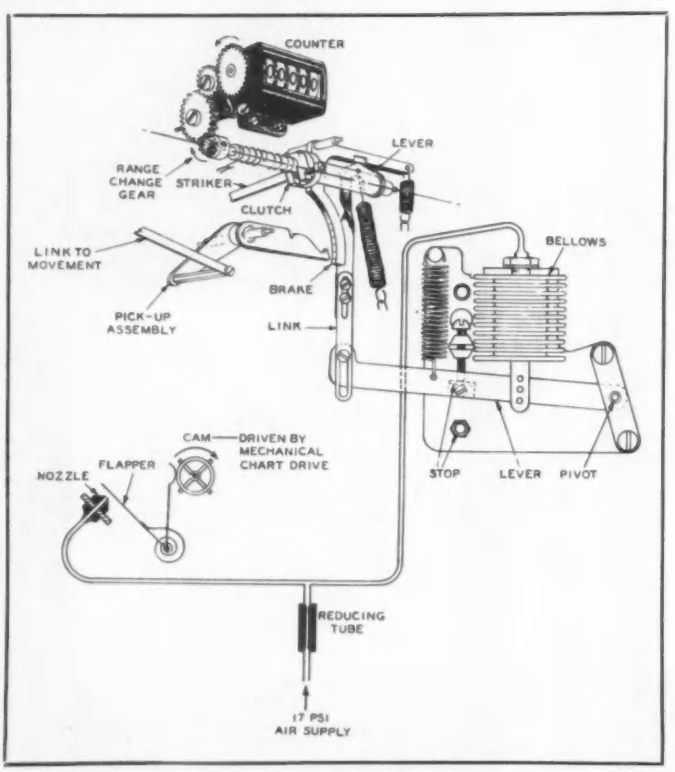

Fig. 6—Schematic diagram of the operation of pneumatic square root integrator for solving problems of intermitting gas measurement.

Put some thought and meter engineering into each installation. Make sure that the operation of the measuring station will be such that good chart records will be obtained consistently. Whether complex automatic controls or just simple regulators or chokes are required, make sure that they are used properly, and not just added to the installation as an afterthought. In other words, design the entire control and measuring system as a unit, not as a number of unrelated items.

Make certain that the gas will be operating above the hydrate expectancy point. Don't base figures on the flow line heat at maximum flow, but rather at minimum flow. It is much less expensive to add a flow line heater when the installation is first made, than it is to shut down producing wells and do it on overtime.

Install the secondary device in ac-

cordance with best practices. Keep the lead lines short. On horizontal runs, come out of the top of the flange. Use straight through flange valves. Provide for easy and quick inspection of the orifice plate by using either an orifice fitting or bypass around the flange. Use either fabricated meter runs or field made runs from carefully selected pipe. And don't guess at the inside diameter of the line. It should be carefully checked with an accurate micrometer gauge, and the diameter plainly stamped on the outside of the line. Provide heat for the meter lead lines and meter to insure continuous operation in cold weather.

Teach operators and pumpers to watch the chart record for signs which indicate operational troubles such as hydrates forming on the edge of the orifice plate, liquid accumulation upstream of the orifice plate, and hydrate plugging of the straightening vanes. A straight line record on a chart indicates a freeze or hydrate formation somewhere in the meter lead lines or in the meter chambers.

In routine checking of meters, check the static pressure as well as the differential, and don't forget to look at the orifice plate. Some operators carefully check the meter at stated periods, and seldom if ever inspect the orifice plate. The meter is only recording the differential and static pressures. If the differential it records is false, due to damage, hydrates, or other faults, don't expect the totals to balance, because they won't.

Intermitting gas flow measurement problems . . .

Since an orifice meter is a rate of flow measuring device, it does not lend itself to measuring intermitting flows accurately, because obviously what you can't read, you can't compute. The most common intermitting application in field production practices is the measurement of gas lift gas. Usually a weekly chart is used and the flowing time is of such short duration that the flow cannot be read with any degree of accuracy. In this

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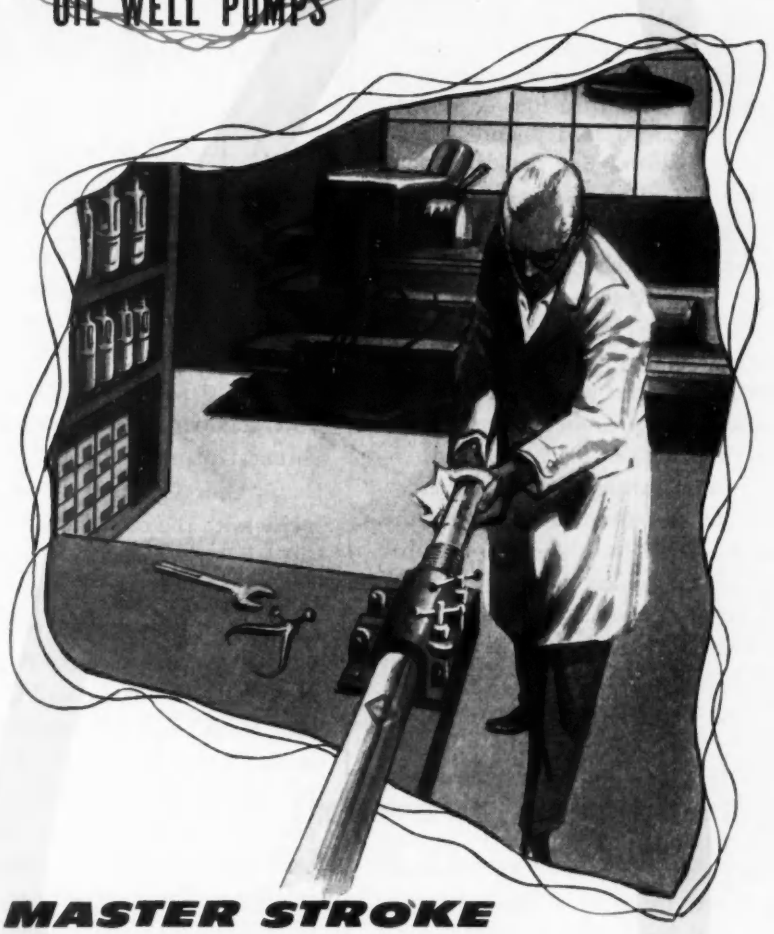

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case, the amount of gas used is often determined by "guestimating" or by agreement between two or more parties. Even the use of a daily chart does not improve the readability to any great degree, as indicated in Figures 5a, 5b and 5c.

Pneumatic integrator. An integrator which utilized 17 pounds per square inch gas pressure to actuate the totalizing mechanism has been adapted to standard meter. After several trials, a standard pneumatic integrating method was decided upon, and has been used quite satisfactorily. It is shown schematically in Figure 6.

Since this mechanism extracts the square root of the differential, and does not allow for changes in static pressure, it does not accurately take care of conditions where the differential and static pressures change at the same time. To this mechanism a pressure compensating movement can be added so that the meter extracts the square root of the differential multiplied by the square root of the absolute static pressure, and then adds the extension of this on a totalizer every 15 seconds. If the orifice size is bored for a specified condition, the totalizer will read directly in gas units. If it is a portable meter, used with several orifice sizes, the difference between two sets of integrator readings corresponds to an extension multiplied by time. This number is multiplied by the corrected hourly orifice coefficient to obtain the quantity of gas passing through the meter. Note that no time factor is required, as the meter itself accounts for time.

This meter was originally developed to measure gas to drilling rigs, where automatic firemen of the on-off type produced unreadable charts. The meter is now used to measure all types of intermitting gas flow. It is quite accurate for this type of measurement. When the flowing time is as long as 100 seconds and the pressure remains fairly constant, test data show accuracies better than 1 percent.

Clutch drive. However, some users will not accept a totalizing meter. They are set up to use a chart integrator, and want a readable chart. For such users, the chart must turn only when gas is flowing, and not turn when there is no gas passing the orifice.

Several manufacturers worked on the development of a clutch which would turn the chart when the pen moved upward from zero. Due to the severity of field conditions, this method has not been entirely successful. However, an adaptation of that principle shows promise of handling some intermitting applications.

At fixed periods, the intermitter opens the valve, and the gas passes until the valve closes. This intermitting time is changed by the pumper as well conditions change, and thus does not necessarily always remain the same. The intermitter is close-coupled to the chart drive mechanism of the meter by a piece of 1-inch OD copper tubing. The fast chart drive starts when the valve opens, and stops when the valve closes, eliminating the troublesome clutch, and handling this type of intermitting application extremely well.

Test separator meters. Coming under the heading of intermitting flows is the test separator. Gas-oil ratios and other valuable well data are determined, with tests on individual wells often being made each month. In about 50 percent of the installations inspected, the meters are improperly used, or results improperly evaluated. Here again is the problem of measuring so-called "kicks," under even more adverse conditions than those we experience with the intermitter. Particularly difficult to measure is the formation gas the well makes after the intermitter head has passed. Usually the orifice plate size is determined by the maximum rate of flow under the head conditions, and the small amount of gas passed as formation gas will hardly show up on the chart. Also, this is of such long duration that it is not practical to tie in a high-speed chart drive. The majority of the applications we have checked showed that more formation gas was passed at differentials of 1 to 1½ inches than that measured during the "kick."

Dual meter system. One successful way formation gas has been measured has been with the use of two meters: one with a range of 100 or 200 inches, and the other with a range of 20 or 10 inches. This dual setting has a flow rangeability of about 8 to 1 (flow ratio) and has been found wide enough to measure the severe extremes often encountered here.

For a new installation, the dual meter is recommended. Meters of this type have both chambers installed on the same case, and one static pen. (See Figure 7.) This arrangement sim-

About the Author

W. A. ROCK is branch manager and sales engineer in the Corpus Christi, Texas, office of The Foxboro Company. A mechanical engineer, Rock has been associated with The Foxboro Company for the past ten years, serving the gas producers, refineries, gasoline plants and petrochemical plants along the South Texas Gulf Coast. He was formerly with the construction division of Foster-Wheeler Corporation of New York, and worked on power plants and refinery units all over the U. S., in Aruba, N. W. I., Venezuela, and Curacao. N. W. I. Rock received his initial instrument training at the Humble Oil & Refining Company plant at Baytown, Texas. He is past president and a founder of the South Texas Section of the Instrument Society of America and a member of the Corpus Christi Engineers Club.

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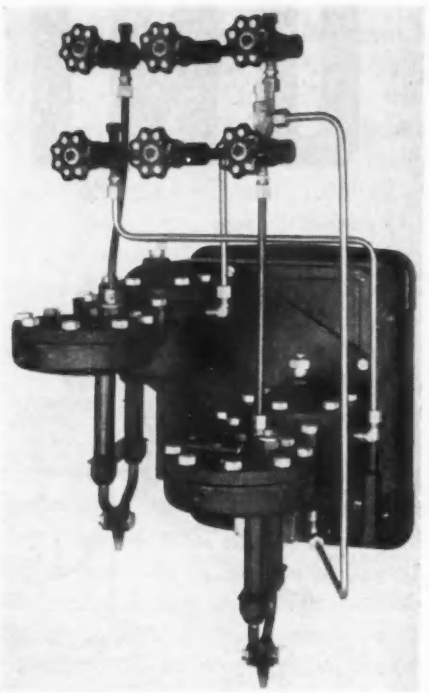

Fig. 7—Dual chambers on the same meter case provide measurement over a wide range of flow as required when measuring formation gas from test separator.

plifies chart computation, and requires fewer charts and only one meter manifold. Of course where one meter is already installed, it might be preferable to simply add a low range meter to give desired rangeability.

Better control of the separator pressure will improve the chart record. The weight loaded mechanical pressure regulator has been replaced with a pilot operated regulator. On one location, this procedure changed the differential line from a continual swing which amounted to about 30 inches of water on the chart, to about a 4-inch differential swing. It was determined in this case that the gas flow was fairly constant into the separator, but that the dump valve removed the oil so fast that the pressure dropped, thus affecting the differential. Adequate pressure control simply produced a readable chart. This is just one of the many ways in which automatic control can be used to help the producer.

pulsation measurement problems . . .

Pulsation is one of the troublesome problems confronting the producer. Wherever a gas compressor is installed, the question eventually comes up, "Do we have an error caused by pulsation?" The answer is simple, al-

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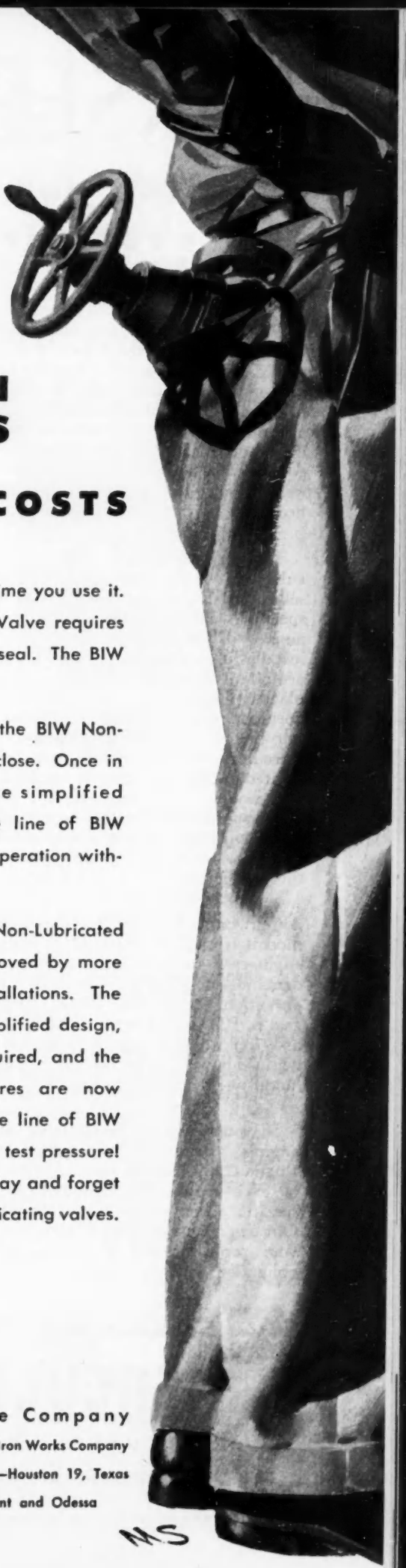

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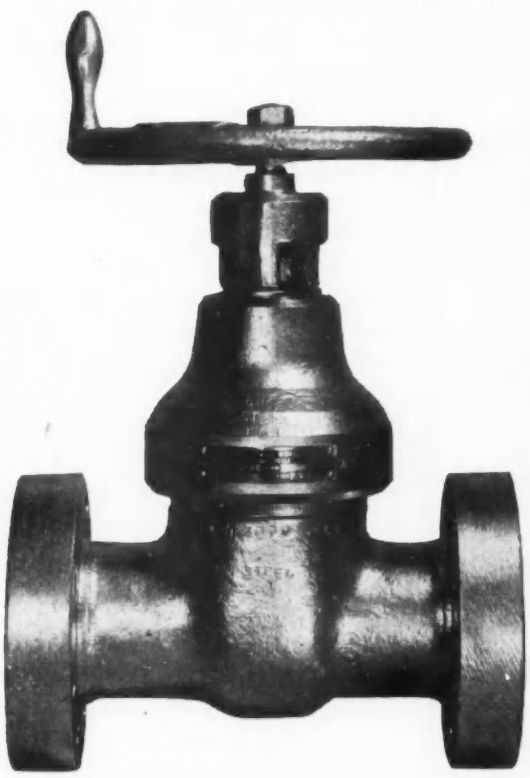

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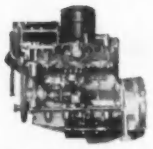

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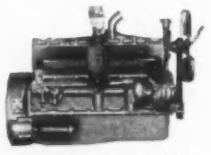

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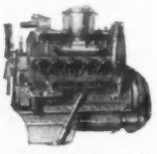

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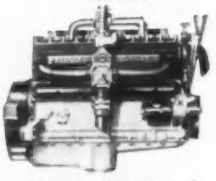

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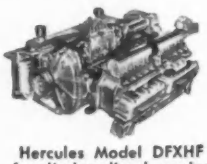

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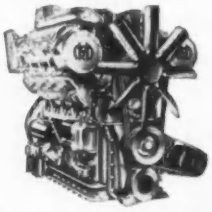

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though not easily arrived at. Of course, if the pulsating effect of the compressor pistons continually shakes apart equipment, then there is sufficient reason to believe that such pulsation would cause a substantial error. But if the station is properly designed, and the meter installation is some distance away, it may not be easy to detect pulsation in the meter records. Some meter men say they can observe a meter and tell if pulsation is a problem. However, many cannot, so another means is used.

Pulsation meter. One such method involves a mechanical device which has been used successfully to determine the presence or absence of pulsation. It consists of an arrangement whereby two pressure-tight cylinders are separated by a metal bellows. A coil spring is adjusted to proper tension by a handwheel and a differential pressure reading is taken from the scale. This, in conjunction with the differential shown by the orifice meter, is referred to a curve supplied by the manufacturer to determine the effect of pulsation or the accuracy of measurement.

The difference between the differential as indicated by the pulsation and the operating differential as read on the meter is the amplitude of the fluctuation. At 20 inches of water differential this should not exceed 24 percent and at 200 inches should not exceed 40 percent of the operating differential for 1 percent measurement tolerance. These limits apply regardless of the type pressure taps used.

Pulsating gas flow is complicated by the presence of reflected pressure waves, differences in timing between peak waves upstream and downstream from the primary device, and other factors which prevent application of simple mechanical analysis.

Pulsation effect reduced. When the gas balance shows that more gas is being discharged from the compressor than enters the compressor suction, the usual question is, "What is wrong with the meter?"

Keep in mind that a meter measures a differential and if the true differential across the orifice is affected by pulsation, the meter will

register a false differential. When this occurs, a pulsation meter should be used to determine if there is a pulsation error, and what is the magnitude of that error. Then the principles shown on pages 354 and 355 of Reference 1 can be applied to correct the trouble.

Here are five points listed in above reference to reduce gas measurement problems due to pulsation:

1. Operate at a higher differential; i.e., in a multiple meter run installation, shut off one or more runs; or install a smaller orifice in an existing meter run.
2. Install a higher range differential gauge and change operating conditions in order to use the increased range.
3. Reduce the pipe run diameter so as to use a higher orifice to pipe diameter ratio, and continue to operate at differentials as high as practicable. Increase the d/D ratio to reduce the pulsation error if the differential remains constant.
4. Install mufflers, headers, restrictions, or combinations of capacity and pressure drop between primary device and source of pulsation to reduce pulsation amplitude.
5. Locate the primary device at a point where the pulsation amplitude is lower (as on the suction side of compressors).

Measurement accuracy important. The day of 3-cent field gas has passed. Every year the price of gas is increasing, and the day of 20-cent gas is not far away. There is no mystery in the accurate measurement of gas, and the producer need not become alarmed about measurement if the basic principles of good measurement are applied, and a little common sense is used.

REFERENCE

[1] Principles and Practices of Flowmeter Engineering, 7th Edition, by L. K. Spink, p. 345 and 355.

ACKNOWLEDGMENT

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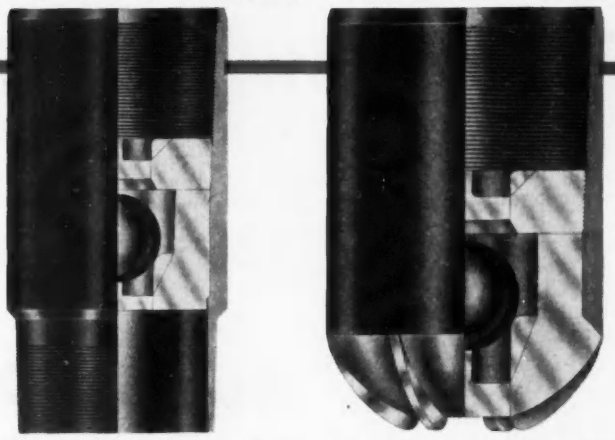

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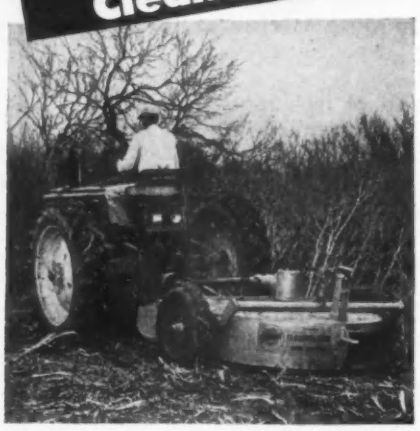

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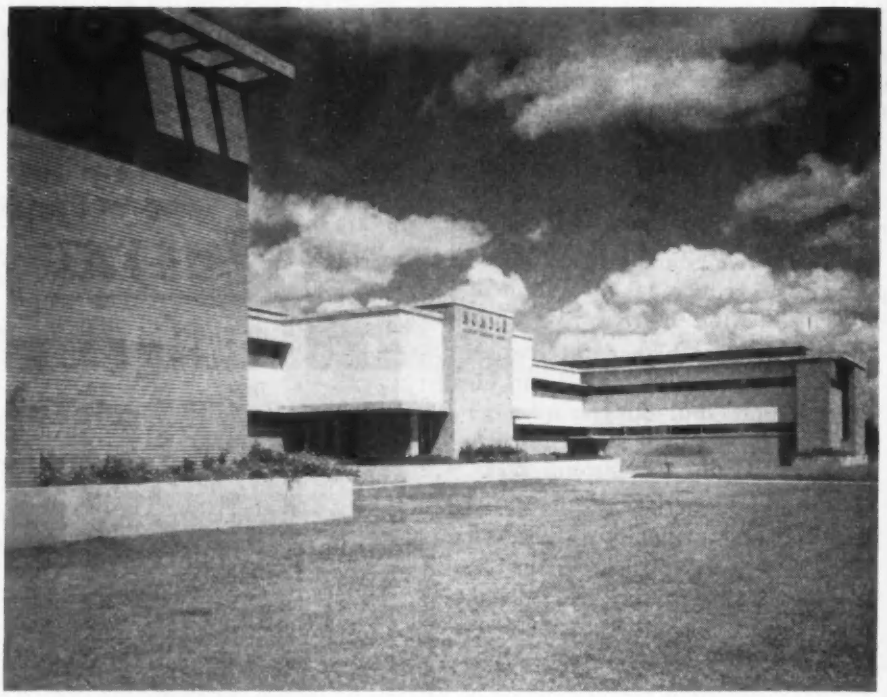


HUMBLE'S NEW HOUSTON RESEARCH CENTER houses production and exploration research teams. Total floor space of two structures is 110,000 square feet.

Humble Dedicates New Houston Research Center

EXPANSON AND centralization of Humble's production and exploration research facilities culminated in the dedication September 11, 1954, of a new and modern $3 million research center. Containing more than 300 laboratories, shops and offices in two buildings, the new center occupies some 110,000 square feet of floor space. Located on a 15-acre tract in southwest Houston, the three-story modern structure will provide some 330 scientists, technicians and assistants with the very latest in scientific instruments and equipment. Air-conditioned throughout, the H-shaped building has individual thermostat controls in each office and laboratory.

Research is divided into two phases.

- Exploration research which seeks to advance the search of new oil reserves.
- Production research, concerned with the problems of drilling for oil, bringing it to the surface and increasing the recovery of know petroleum deposits.

Exploration research. This branch is divided into geophysics, geologic and geochemical groups. Primary task of the geophysics group is to improve existing methods and develop new methods of applying measurements of physical properties of the earth and earth materials to the search for petroleum. Fields of endeavor in this group include seismic, gravity, magnetic and well logging methods.

The geologic group has its aim at improving the application of fundamentals of geology in the exploration for oil and gas as well as develop new ideas which will aid the oil-finding effort. This research division was formerly organized in 1948.

The geochemical research group works closely with the geologic group. Most of the work is fundamental long range research. Current activities include studies of clay minerals, carbonate rocks and geologic age determinations.

Production research. With the aid of electric reservoir analyzers, complicated electronic computers which

save considerable man-hours in long calculations, and many other instruments, Humble's production research group is learning more and more about oil recovery and the fundamental principles of reservoir behavior. Work is divided into: reservoir behavior, fluid mechanics, behavior of reservoir fluids, well logging interpretation, drilling muds, lost returns, well cementing, corrosion, subsurface instruments and interpretation of thermal measurements.

In addition to working in close cooperation with the production research division on many projects, the Petroleum Engineering Division carries on a number of research projects of its own. This group provides certain technical services to Humble's far-flung field operations, in addition to doing equipment research, and working on drilling techniques. It also concerns itself with unusual problems, such as marine operations. Under this group may be found the reservoir engineering laboratory which performs hydrocarbon analysis, core analysis, and makes special temperature and pressure surveys. It also consists of a formation evaluation and reservoir engineering training group which formulates plans for and coordination with the operating division to train field personnel.

The computing group assists the general office, divisions, and field petroleum engineering personnel in developing the numerical results necessary to engineering design and analysis. Facilities of this group include a general purpose electronic digital calculator, an electrical oil reservoir analyzer and potentiometric type oil reservoir models.

The new Houston Research Center which houses exploration and production research is but a part of Humble's vast research facilities. Product and refining research is carried on at the company's Baytown Research center, opened in 1951. Humble now has almost 600 employes devoting full time to a broad research program which costs between $5 and $6 million annually.

Highlighting the dedication ceremonies of the Houston Research Center, Hines Baker, Humble's president, said that the new center is a symbol of the growing importance of research in the Humble Companies, in the oil industry and in the daily lives of all people in the modern world.

—The End

Completion

Producing

Work-Over

Otis Side-Door Chokes and Landing Nipples are standard operating practice for both single- and two-zone wells throughout the oil country

Otis Side-Door Tools

OTIS PRESSURE CONTROL, INC.

Branches Throughout the Oil Country

PRESSURE CONTROL OTIS SERVICE - EQUIPMENT

How to do it

PRODUCTION HINTS

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas.

Drive Shaft Guard Made From 3/16-Inch Plate

A neat and inexpensive guard for the drive shaft on a mud pump can be made from three-sixteenths-inch plate. The guard pictured also serves as a stile to cross over the shaft and provides a stand from which adjustments can be made to the engine.

Flat steel plate forms the sides of the step and diamond plate forms the steps themselves.

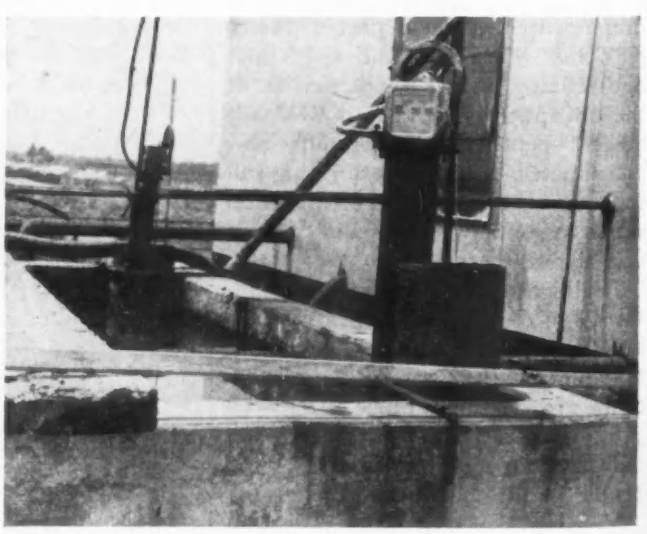
Old Walking Beam Supports Pumping Unit

Where the old standard rig front is used on pumping wells, the operator soon finds out that the operating cost is high and it is more economical to install a modern pumping unit run by a small engine.

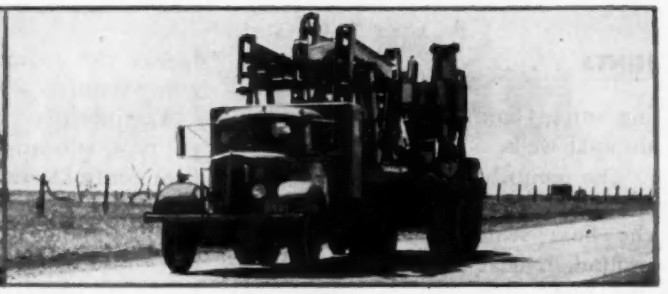
One part that can be salvaged from the old rig front is the walking beam which can be paired with another one and used for a foundation for the modern unit. The old walking beams are high enough to give clearance for the crank counterweights, and it is only necessary to place them on skids and install the unit.

The two beams are just the right thickness to go between the counterweights, yet wide enough to provide stability for the unit. Before they are spotted, U-bolts are installed to match the holes in both ends of the unit so that the unit can easily be spotted on the beams and fastened down.

Water Level Starts, Stops Pumps



The control of two electrically-driven centrifugal pumps used in a salt water disposal system is determined by the liquid level in the salt water sump pit. One centrifugal pump takes water from a settling pit nearby and pumps it into this treating sump of reinforced concrete. The other centrifugal pump takes suction from the treat-



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New T12D-D80Z
Wide Frame Unit.

Years of Service

American Gives You MORE

Your American Pumping Unit is delivered right *when* you want it—right *where* you want it . . . at well site on your lease. This factory-to-lease safe delivery of your unit is standard American policy and is included in your zone price on all units ordered in truck load quantities.

AMERICAN FOLLOWS UP!

American service does not stop with delivery. American maintains a complete service record on all units. Trained field men periodically check American Pumping Units in the field—offer suggestions on maintenance—show you how to get even longer wear, more satisfactory service, and low-cost pumping from your unit. These same field men are also available to give prompt service in case of an emergency.

Consider this trouble-free delivery and extra years of service when you buy your next unit—you'll find it costs less to buy AMERICAN.

AMCOT AMERICAN MANUFACTURING COMPANY OF TEXAS

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ing sump and pumps water into disposal wells.

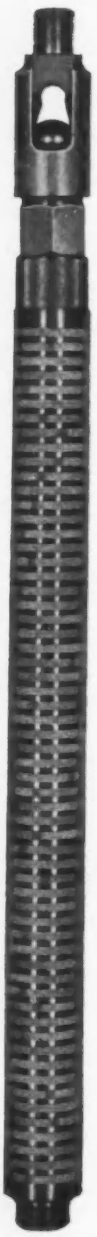
The pump bringing clear salt water into this concrete pit is controlled by the float switch in the left background. A float placed inside a housing and connected to electrical switches by means of steel wire and a pulley starts and stops the electric motor driving the pump. When the float is low, the switch contacts close, and the pump starts flowing water from settling pits into this concrete pit. At a predetermined level, the float breaks the switch contacts and the pump stops.

The injection pump, also a centrifugal type, is controlled similarly by the float control switch in the foreground. However, it operates just the reverse from the other unit. When the water level reaches a predetermined lower level, the pump stops injecting salt water into the disposal system. When the water reaches a predetermined level, it starts injecting water. Thus, there are dual controls on two pumps: one pump supplies the pit with clear water; the other pump injects the water into disposal wells.

Regulator Protected By Galvanized Hood

Deterioration of this regulator due to exposure to weather has been minimized by keeping a galvanized hood over it at all times. The exposed section of the polished valve stem immediately above the valve housing is carefully wrapped with oil-soaked rags tied around the valve stem with string. The rags are placed so that they will not hinder in any way the normal function of the regulator, but keep the stem from corroding and causing the valve to stick.

After several years of continuous operation, this regulator has the outward appearance of a factory new regulator, with the exception of some dust and cobwebs which have collected on the diaphragm cover. The control gas supply line is directed downward, then to the tap where pressure is controlled. In this case, it was on the low-pressure side, operating at about 40 pounds per square inch. Arrangement of the control gas connections permit the enclosure of the regulator without interference from the control piping. The hood was made in the tin shop from galvanized sheeting. The top was closed off and a handle attached. The can allows the pumper or station engineer to check quickly the regulator, make minor adjustments or service it if necessary.



Patent No. Re20574

LOW COST PUMPING!

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MARTIN PLUNGER

Grooved Bodies—Split Rubber & Duck Rings

1. It repairs for ⅓ to ¼ the cost of a new plunger. Only the rings are replaced.
2. Lasts for years.
3. Gives longer runs and therefore less pulling cost.
4. Saves 50% to 80% on barrel or tube cost because of slow rate of wear.
5. Increases production in many cases.

SAND FRACtured wells, for example, can be extra hard on ordinary pumps, but many Operators are finding it easy to handle the sand with Martin Plungers. They handle salt water, sand and any gravity of oil from any depth to 10,000 ft. more economically than any other equipment. They may be used in stroke-thru installations when necessary.

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PROOF OF CORROSION CONTROL

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with *Visco*® ANTI-CORROSION TREATMENT

IT took only 30 days for the two steel coupons shown at right above to corrode almost away in the stream of a secondary-recovery well in Kansas. Both coupons, where not corroded through, are wafer thin. An anti-corrosion chemical was being fed at the rate of one pint per day, yet the average corrosion rate on the coupons was 216 mils *per year.

In the same well, Visco-treated with the same amount of chemical per day, the coupons at left above showed a corrosion rate of only 8.1 mils per year after 29 days' exposure.

Visco Chemicals cut the corrosion rate over 96%!

For corrosion control *results* and treating *economy,* call your Visco Representative, *now.*

*1 mil=.001 inch. A corrosion rate of 216 mils per year means that the corrosive attack, if uniform, would have corroded away the entire surface of the metal to a depth of .216 inches in a year. However, the real danger of high corrosion rates, as the coupon shows, is the much deeper and faster penetration occurring at localized areas.

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***Visco*... CONSISTENTLY EFFICIENT OIL INDUSTRY CHEMICALS**

United Towing Co. reports LATTICE BRAID* *outlasts* previous pump packings 26 to 1

*Registered Trademark. *Only* Garlock makes LATTICE BRAID rod and shaft packings.

United Towing Company of Wilmington, Cal. tried a number of packings on their rotary gear pumps handling *cold molasses* and operating at 120 p.s.i. In starting the pumps, the cold molasses would ruin these packings. In fact, no packing would last more than 8 to 10 hours. That is, until United Towing tried rugged LATTICE BRAID asbestos packing with wire insertion and wire corners. In actual running time, LATTICE BRAID has lasted for 260 hours—26 times longer than any previous packing.

Put Garlock LATTICE BRAID Packing to work for your company. All the braided strands of this unique packing are lattice linked together into one structural unit. The strands hold together even when the packing is worn far beyond the limits of wear of ordinary braided packings.

LATTICE BRAID is made from flax, cotton, asbestos, wire-inserted asbestos, Teflon, and asbestos with Teflon impregnation—for various types of services.

Get all the facts about LATTICE BRAID *Packings. Contact your Garlock representative or write for new folder AD-131.*

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

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GARLOCK LATTICE BRAID PACKING

Electric Fence Guards Temporary Open Pits

A temporary fence of light construction may be placed around open pits that are to be covered later. Such enclosures protect temporary burning pits, salt water vats, etc., that will be replaced and covered in a short time. During the interim, it is necessary to keep the landowner's prize cattle from breaking legs or drinking polluted salt water.

A simple electric fence has been used with some success. It is nothing more than a light model of the ordinary farmer's fence using light weight rods to support the electric wires.

The fence is charged by a small unit which operates from dry cell batteries. The unit is fastened to a short section of pipe driven in the ground along the fence line. The remaining light rods may be driven in by hammer, or if the ground is of loose soil, they may be punched in the earth by hand. The charge carried in the fence wires is not powerful enough to hurt personnel or cattle, but it will scare stock from trying to pass through the fence.

The complete outfit is light enough that one man can install and remove it. It does provide some protection as a temporary measure.

Airfield Mats Used For Shallow Stream Crossing

Surplus airfield landing mats, used extensively by the military abroad during World War II, were put to

good use by a pumper to ford a shallow stream. The approaches to the stream as well as the stream bottom were of sand, and even a pickup truck would soon become bogged. This stream caused the pumper to drive his truck many miles around it to cross on state highway bridges to serve leases located on both sides of the shallow waterway.

The airplane landing mats required no alterations, and were laid on the approaches and stream bottom in the same manner that these mats are placed on smooth ground to form a landing strip. The mats provide adequate footing for the light weight pickup trucks, and they are heavy enough not to be washed away during seasonal high water.

Small Parts Cleaned in Rotating Wire Drum

Cleaning the thousands of small parts involved in production equipment can be simplified and the time required reduced by using a rotating cage-type cleaning unit.

Materials for construction of the cleaner include two circular plates for the cage ends, eight metal bars welded to these ends to support the hardware cloth, and a pin welded to the center of each end to serve as an axle. One panel of the cage is hinged to allow insertion and removal of the parts.

The vat containing cleaning solution in which the cage is rotated is built of sheet metal. Is is suspended between angle-iron supports, which are notched for the axle pins, as shown. When the cage is loaded with small parts, it is lowered into the vat

For sandy pumping use the new D+B 3-tube pump

The new D+B 3-Tube Pump is designed to handle excessively abrasive fluids and to operate efficiently at high bottom hole temperatures.

The D+B 3-Tube Pump consists of three telescoping tubes that are loose-fitting and free-falling. The middle or standing tube is induction-hardened to provide longer life and eliminate galling. The plunger is precision-ground on the O.D. to give longer service.

The loose-fitting plunger prevents sticking and sets up a turbulence that keeps the sand in suspension. An optional bottom discharge valve assembly aids in scavenging sand from the annular space between tubing and pump.

Call your nearest CONTINENTAL or D+B store for details on sub-surface pumps and parts.

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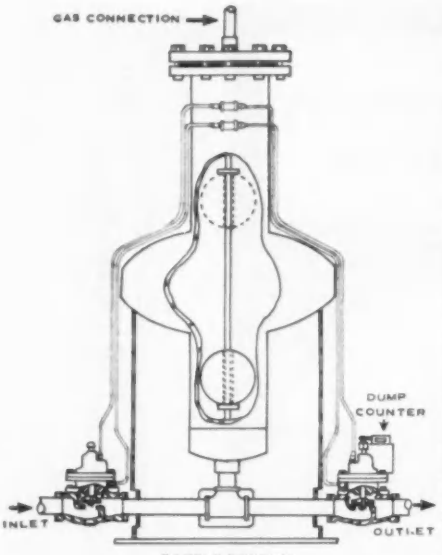
D+B
• DEEP WELL PUMPS
• SUCKER RODS
• COUPLINGS

E-172

(For more data on advertised products, use Readers' Service blue cards, last page this issue.)



PATENT PENDING

ROLOCHECK

TRADE MARK

The New Oil Well Meter

A new oil well meter has been developed which is simple in design, yet very accurate and eliminates expensive maintenance problems caused by gas, sand and other solids in crude oil. The meter has a high maximum rate and features a zero minimum rate. The new Model No. RM 1-24 will handle as much as 1,440 bbl. per day at 12 psi.

Gas and sand will not affect the new meter any more than they would affect normal control valves in oil lines. The meter actually dumps a positive calibrated dump each time. It may be installed on existing heater-treaters, vertical or horizontal separators. The Rolocheck meter eliminates liquid level controls on the separator as it actually controls the liquid level in the vessel.

OPERATION

(1) Filling: When float hits lower stop, pilot trips to close outlet valve and open inlet valve simultaneously.

(2) Dumping: When float hits upper stop, pilot trips to open outlet valve and close inlet valve simultaneously.

ACCESSORIES

GAGE, COCKS, GLASS, & GUARD RODS
0-200° THERMOMETER & WELL

SPECIFICATIONS

Type	RM 1-24
Working Pressure	150 PSI
Capacity B.P.D.	MIN.—O. Max.—1440*
Height	4'-6"
Width	2'-0"
Weight	356 Lbs.
Gas Connection	1"
Oil Outlet	1½"
Oil Inlet	1½"

*At 12 psi. pressure differential. Available with 2" valves for greater capacity.

ROLO MANUFACTURING COMPANY

P. O. Box 6763, Houston 5, Texas

BRANCHES: Corpus Christi, Midland, Kilgore, Tulsa, New Orleans, Los Angeles, Casper, Mt. Vernon (Illinois); Lima, Peru.
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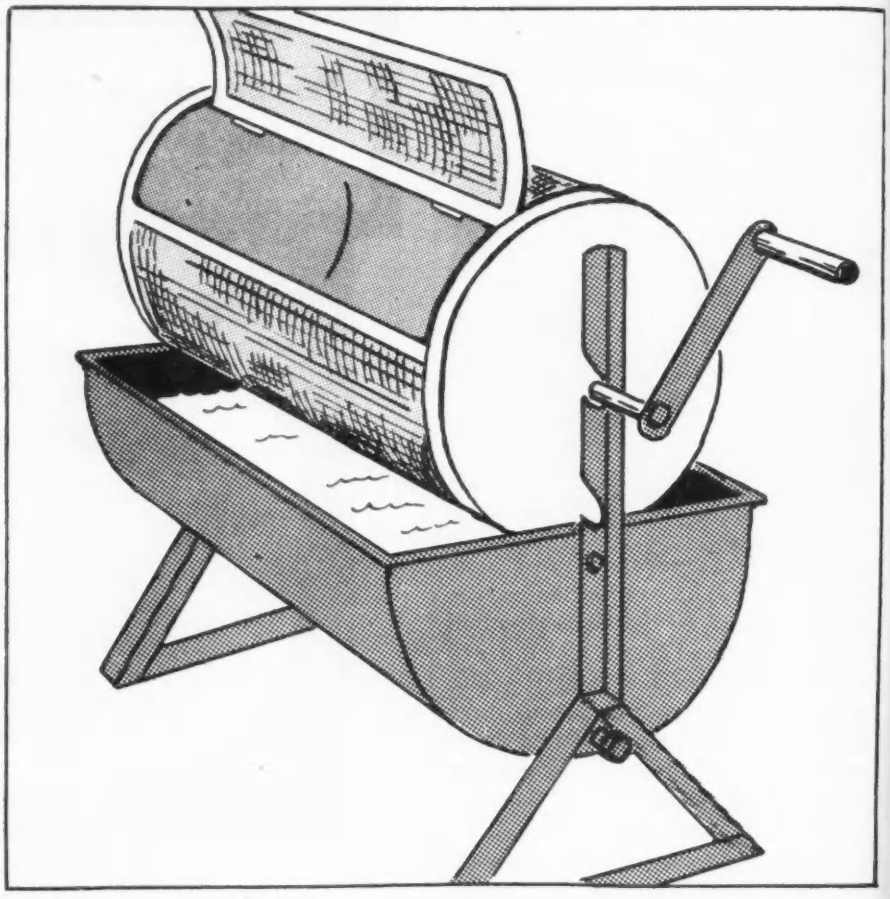


by placing the axle pins on the bottom notches of the angle iron member. Then, the cage is rotated until the parts are thoroughly cleaned.

The cage is raised back up to the top notch position and the parts allowed to drain of cleaning solution. Rotation in this position will allow all the cleaning fluid to drain from the small parts. After allowing to dry in the air for a few minutes, the parts may be removed, clean and dry.

The crank handle on the drum axle permits rotation of the drum allowing the parts to tumble, causing a washing action in the solution.

THE WESTERN CHEMICAL FEEDER

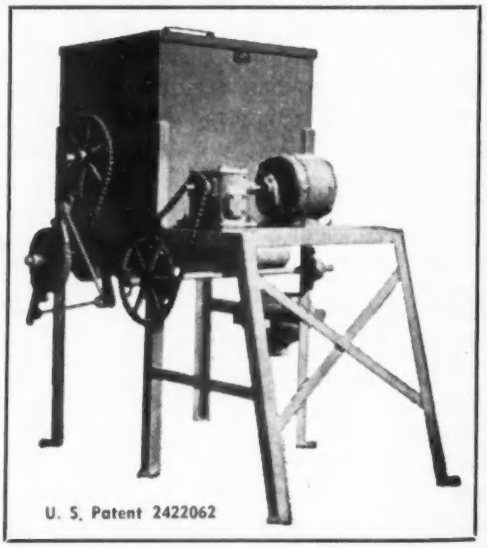
the dependable, economical water treater

CHECK THESE FEATURES:

- Used in Oil Well Water Flooding, Municipal Water Treating Plants, Canneries, etc.
- Can be driven by water entering plant for treatment.
- Maintains pre-set water-chemical ratio through a wide rate-of-flow range.
- Adjustable two ways, to feed from a few pounds to several hundred pounds of chemicals per day.
- Also can be equipped with electric motor, or gas engine drive.
- Made to your specifications in various sizes.
- In use the world over.

Whatever your water treating problems may be, investigate the Western Feeder. Write for literature and prices.

For complete description see Page 2630 of the Composite Catalog.



U. S. Patent 2422062

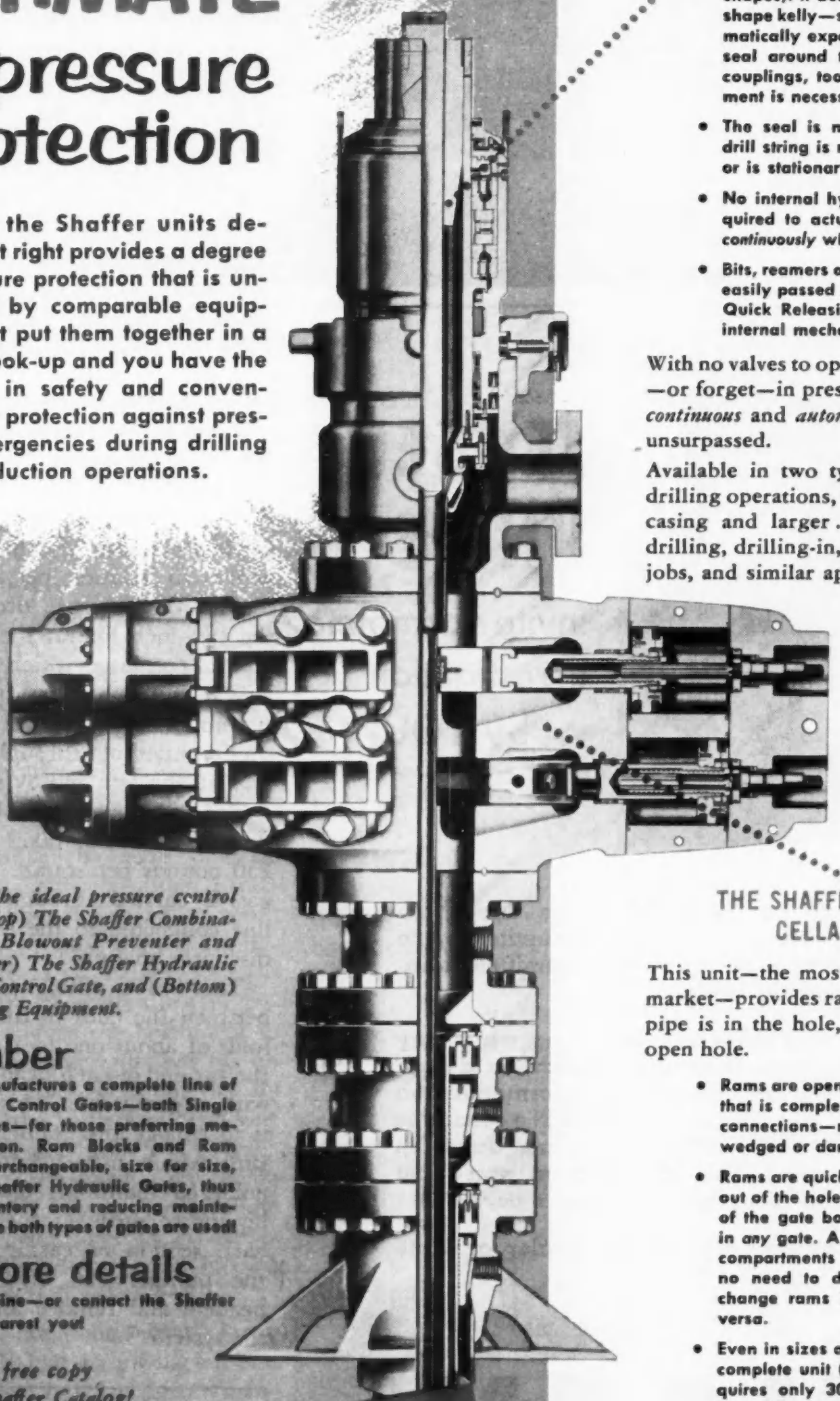
Manufactured By

KEYSTONE SUPPLY CO.

312 E. Cherokee St. Phone LD-10
NOWATA, OKLA.

For the ULTIMATE in pressure protection

Each of the Shaffer units described at right provides a degree of pressure protection that is unmatched by comparable equipment. But put them together in a single hook-up and you have the ultimate in safety and convenience for protection against pressure emergencies during drilling and production operations.



Illustrated is the ideal pressure control hook-up . . . (Top) The Shaffer Combination Rotating Blowout Preventer and Stripper, (Center) The Shaffer Hydraulic Double Cellar Control Gate, and (Bottom) Shaffer Landing Equipment.

Remember

Shaffer also manufactures a complete line of Mechanical Cellar Control Gates—both Single and Double types—for those preferring mechanical operation. Ram Blocks and Ram Rubbers are interchangeable, size for size, with those in Shaffer Hydraulic Gates, thus simplifying inventory and reducing maintenance costs where both types of gates are used!

Want more details

Just drop us a line—or contact the Shaffer representative nearest you!

Send for your free copy of the latest Shaffer Catalog!

THE SHAFFER COMBINATION ROTATING BLOWOUT PREVENTER AND STRIPPER

This unit provides—in compact space—every necessary feature for efficient, simplified pressure control while the drill string is in the hole . . .

- **It *automatically* maintains a continuous seal around the different diameters and shapes in the drill string (except bits, reamers and similar abnormally large shapes). It automatically seals around pipe and any shape kelly—square, hexagon or octagon—and automatically expands and contracts to maintain a tight seal around the varying diameters of kelly, pipe, couplings, tool joints, subs, etc. No manual adjustment is necessary!**
- **The seal is maintained automatically whether the drill string is rotating—is being raised or lowered—or is stationary.**
- **No internal hydraulic or mechanical pressure is required to actuate the unit—the seal is maintained *continuously* while the drill string is in the hole.**
- **Bits, reamers and other abnormally large tools can be easily passed through the unit by merely rotating the Quick Releasing Bonnet ⅛ turn and removing the internal mechanism as a unit. It's simple, quick!**

With no valves to open or close, nothing to remember—or forget—in pressure emergencies, this unit gives *continuous* and *automatic* pressure protection that is unsurpassed.

Available in two types—Type 50 for all kinds of drilling operations, including drilling through 10¾" casing and larger . . . and Type 51 for slim hole drilling, drilling-in, re-work operations, production jobs, and similar applications.

THE SHAFFER HYDRAULIC DOUBLE CELLAR CONTROL GATE

This unit—the most advanced Control Gate on the market—provides rams for shutting off the well when pipe is in the hole, as well as rams for sealing off open hole.

- **Rams are opened and closed by *direct* hydraulic drive that is completely enclosed. No yokes or secondary connections—no exposed moving parts to become wedged or damaged.**
- **Rams are quickly changed—whether the pipe is in or out of the hole—by simply opening doors in the side of the gate body—the fastest, easiest ram changes in *any* gate. And rams in both the upper and lower compartments are changed with equal ease. There's no need to dismantle the upper compartment to change rams in the lower compartment — or vice versa.**
- **Even in sizes as large as 13⅝" (12" Series 900) the complete unit (including *two* ram compartments) requires only 30" cellar height—smaller sizes even less. What's more, these compact dimensions are *fixed*—there's no need to allow extra space at the *ends* for expanding the gate to change rams . . . nor is extra space required above the gate to replace the rams. Shaffer compactness is *real* compactness!**
- **With Shaffer Gates, the same compact design is equally efficient for either low or high pressure operations. There's no need to choose between compactness and full pressure protection. The same basic Shaffer design gives BOTH!**

There are many other advancements built into Shaffer Hydraulic Double Cellar Control Gates—and the same features are also available in a complete range of Shaffer Hydraulic *Single* Cellar Control Gates for those preferring this type of installation.

See the Shaffer Section of your latest Composite Catalog.

SHAFFER

31 years OF OIL TOOL LEADERSHIP

HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT • FISHING TOOLS THAT EXCEL

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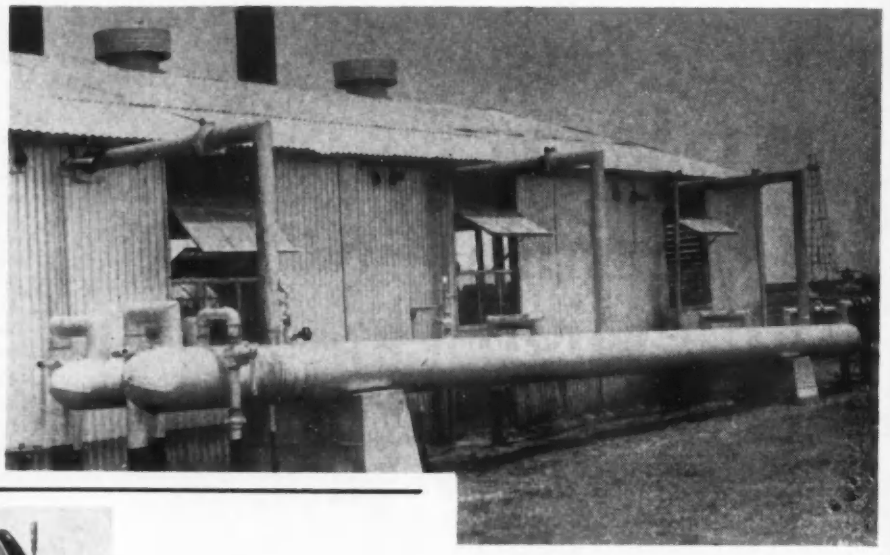
Compressor Manifolds Have Drip Arrangement



Any insurance taken to prevent liquids from entering the suction of gas compressors is well worth the time and initial cost, for a little condensate or moisture in the gas can do untold damage to the compressor. There are many different types of scrubbers and drip arrangements found throughout the oil country, and here is a simple idea that has proven itself over many years of constant operation.

The long, inclined sections of casing which have been orange-peeled at both ends and supported on concrete foundations are suction and discharge manifolds for three gas compressors. The larger of the two casing sections, that section in the foreground, is the suction manifold. Suction pressure is about 75 pounds per square inch. Should the pressure drop to 40 psi, the two-inch line at the left end ties into a regulator which will open to provide adequate gas from the field system at 40 psi. Gas comes into this suction manifold through a three-inch line at the left end as shown.

The discharge manifold, behind the suction manifold, takes gas at about 250 pounds per square inch and this gas is carried through a three-inch line connected to the left end of the discharge manifold.

There is a difference in elevation between the ends of these two manifolds of about one foot or more. And the far end of each header is equipped with a drain line. This arrangement is to collect any condensate or moisture which may accumulate in the enlarged manifolds and allow these liquids to settle at the lower end of each section of casing. Periodically, the pumper can blow down these headers and remove all liquids from the system.

Want to earn some money?

• Share your ideas for a better way to do or make something. Send a picture illustrating your idea with a written description to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas.

JENSEN UNITS

invite a complete investigation . . . by YOU!

Investigations seem to be the order of the day—from Washington to Walla Walla. Therefore, we invite you to appoint yourself chairman of your own committee to investigate JENSEN Pumping Units.

Starting now, make it a point to ask owners what they think about JENSEN Units. Investigate JENSEN's design and construction . . . get first-hand information on JENSEN's economy . . . examine JENSEN's features closely . . . discover why JENSEN Pumping Units lift MORE oil for LESS money. This investigation won't cost you a cent—and it can mean dollars in your pocket!

If you wish, see your nearest JENSEN Dealer or write us a card or letter.

JENSEN

BROS. MFG. CO., INC.

Coffeyville, Kansas, U.S.A.

EXPORT OFFICE: 50 CHURCH STREET, NEW YORK CITY

Parentis Is Now West Europe's No. 1 Field

Four rigs are pushing development work as Esso Standard Francaise brings in Well 3 as a 2000-barrel-a-day producer.

A second oil producer in the Parentis field, Southern France, brought in by the discovering company, Esso Standard Francaise, definitely marks that field as the most important one to date in Western Europe. The new well is Parentis 3, which from 100 feet of saturated lime is producing about 2000 barrels per day on a half-inch choke.

Four rigs are now running in the field and, unless plans are changed, operations will continue with four rigs.

The first well drilled, Parentis 1, was flowing in September 3500 barrels of 34 gravity sweet oil per day through a half-inch choke. The oil comes from a Cretaceous lime, a fractured vuggy lime occurring at about 7775 feet. Apparently, the pay formation runs 90 to 125 feet thick. Parentis 1 did not drill through the pay but stopped well before the bottom of it. No. 1 is the highest well thus far on the structure which is about five by possibly as much as two miles in size. Drilling is not too difficult, average daily footage on a normal day being about 180 to 190 feet. However, some difficulty is encountered in lost circulation but only about as much as is usually found in lime drilling.

Parentis 2 ran considerably lower than No. 1. It had a showing around 1500-1600 feet, but has been abandoned as dry.

Parentis 3 also ran lower, but only about 60 feet, on the structure.

No. 4, due for completion shortly, is also running somewhat lower than No. 1.

Also, Esso Standard Francaise has geological work under way—and nearing completion—at Carcans, 50 miles north of Parentis, and is planning to drill a wildcat. Preliminary geophysical work is under way, too, some distance west of Parentis.

Meanwhile, the government-owned Regie Autonome de Petroles has drilled a wildcat on the Bray anticline, near Beauvais, about 40 miles north of Paris. Reportedly, the well was drilled to the basement and plugged back, recovering clean oil in a Jurassic limestone.

The oil is being shipped by tank car to the Port Jerome refinery of the company, a distance of about 400 miles.

So naturally, there is talk of a pipe line. Parentis field is only 55 miles from Bordeaux, itself an important French port.

When actual pipe line construction will begin has not been indicated. The Ministry of Commerce and Industry granted Esso Standard a special privilege in permitting it to start commercial production from Parentis immediately, rather than waiting the usual 20 months required from a discovery of oil to formal granting of a production concession. At the moment, it is reported that Esso has no formal production concession, and it is indicated that as soon as this formality is cleared pipe line planning may be expected to start.

Esso Standard Francaise is owned 63.3 percent by Standard Oil Company (New Jersey); 18.3 percent by Gulf Oil Corporation, and the remainder by private French capital. Esso Standard Francaise was largely a refining company (formerly known as Standard Francaise des Petroles), and possibly its producing activities will be handled by the exploration department.

One reason for this could be that, under its concession with the French Government, once production is found, a new producing company must be formed in which the French Government is to have a 10 percent interest. In other words, Esso Standard Francaise will hold a 90 percent interest and the French Government a 10 percent interest in production from Parentis field.

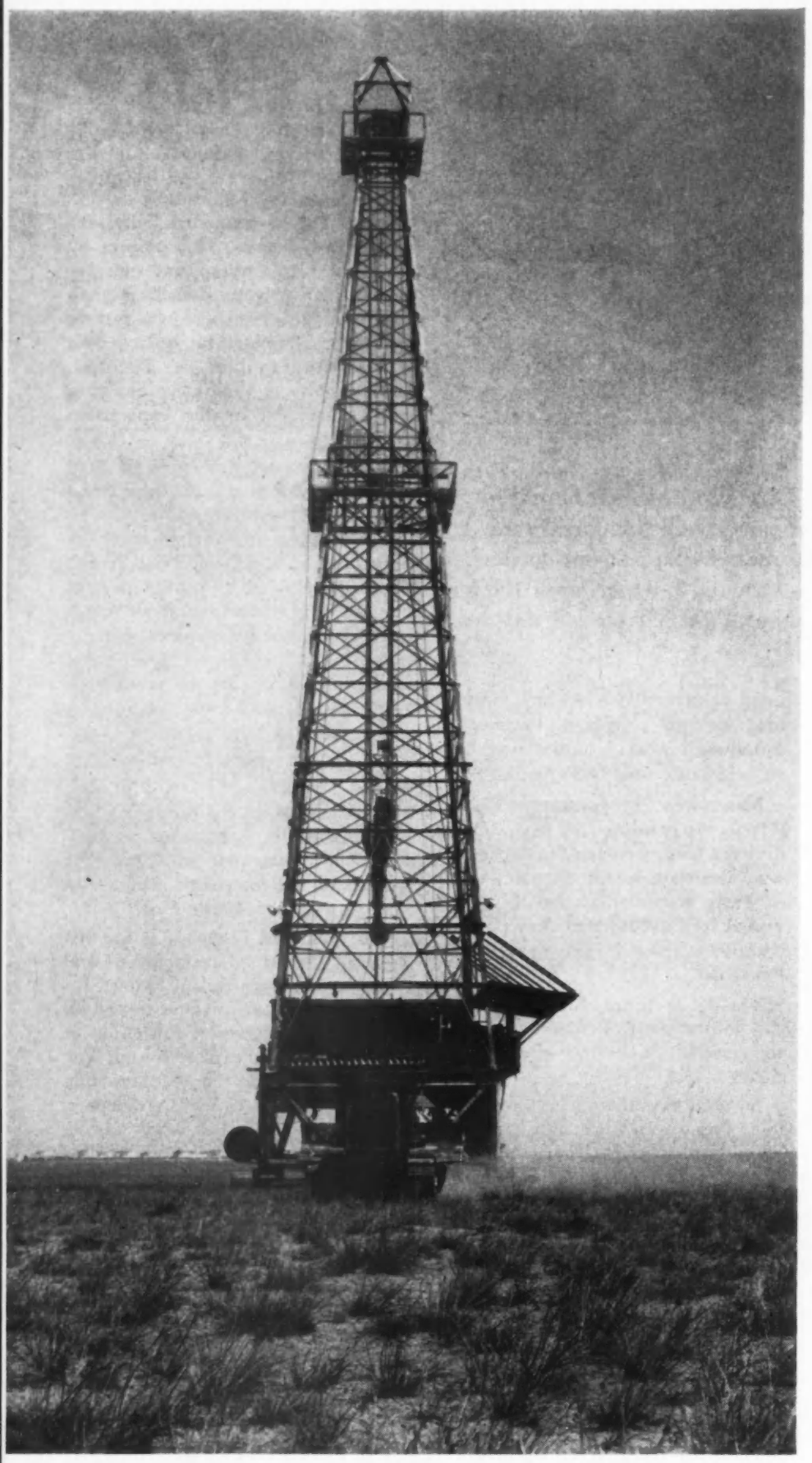
President of Esso Standard Francaise is Serge Scheer. Hans Hlauschek is chief geologist.

C. D. Alworth is producing coordinator of Jersey Standard in London and an advisor on producing matters of the company's affiliates in Europe and the Middle East.

Esso Standard Francaise is the first privately owned oil company to find commercial production in France. Indeed, it is the first privately owned oil company to be given a concession or lease in France to explore for oil. The company was a refining-marketing company, so an exploration department was created and work started. Parentis 1 was not the first well drilled by the company, but the second and followed two years of thorough geological and geophysical work. The first well was dry.

The successful strike at Parentis naturally created a sensation in France, not only because it is the biggest producing well ever to be drilled in France but also because it is the biggest in Western Europe in many years, so the press made much of it. That it will or already is having an influence on the attitude of the French government toward privately owned oil companies seems very likely.

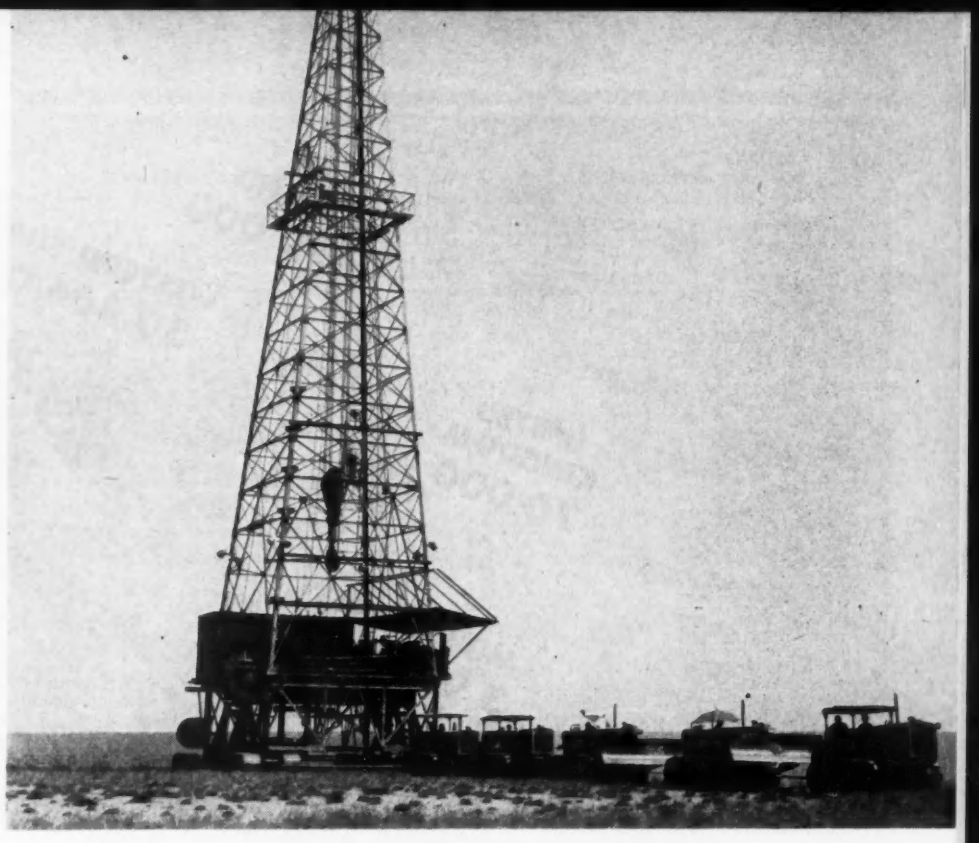
—**The End**



THE START of the 99-mile move, with Ahmadi in the background. This is the 110-ton load—136-foot derrick, substructure, hoisting drum end of a heavy-duty drilling rig.

FIVE TRACTORS here are moving the light end of the job—95 tons of three eight-cylinder drilling engines, pumps, and the transmission half of the drawworks. Here it was smooth going. Note blades raised. Lowered, they were called into use to make the way passable.

This move of 99 miles, over difficult, roadless terrain, of a 136-foot derrick, heavy drilling rig, three engines, pumps, etc.—total load weighing 205 tons—is believed to be a world record. If any WORLD OIL reader has information on a record surpassing it, we should like to know it.—*The Editor.*



ROLLING ALONG in a temperature of 110 degrees in the shade and a low of 80. In the sun it was 160 degrees. This is a side view of the heavy part of the world record convoy.

A Record Run in the Sun

Kuwait Oil Company moves a 136-foot derrick, heavy drilling rig, pumps, etc.—totaling 205 tons—99 miles in 40 hours. And in 160-degree temperature!

WHAT PROBABLY is a new world's record for moving a derrick, drilling rig and accessories, was accomplished early in August of this year by Kuwait Oil Company in Kuwait—99 miles in 40 hours actual moving time!

The 136-foot derrick and heavy duty drilling rig, weighing 110 tons, and the three eight-cylinder drilling engines, pumps and transmission half of the drawworks, weighing 95 tons, were moved overland from Ahmadi to a point in North Kuwait. While the direct route between the two places was only 85 miles, escarpment difficulties necessitated a longer trip of 99 miles.

As it was, three escarpments, including a rather difficult one, had to be crossed, as well as several shallow stream beds, or *wadis*. The terrain was covered by deep sand and sandy hillocks. The trip started at 400 feet above sea level, dropped to sea level and climbed back up to 200 feet above sea level.

Loading was accomplished in a short time by means of four 50-ton hydraulic jacks which hoisted the two loads onto two sets of four 34-inch crawler-type wheels.

A cook and ration truck took care of the food requirements en route. A high cut-side truck, covered with canvas, provided shelter and sleeping quarters for part of the crew. Fuel and service had to be maintained for the ten tractors used to pull the two heavy loads.

Temperatures ranged from 110° F. in the shade (160° out in the sun) down to a low of 80° at night. The convoy was not disturbed by rain!

The move started at 1 p.m. on August 4,, and eight miles were traversed in 3½ hours moving time. On August 5, traveling 9½ hours, the convoy covered 24 miles; on August 6, 10 miles were covered in 3½ hours. Much of that day and the next the tractors were used as bulldozers, clearing passage for the convoy.

August 7 saw eight miles covered in 3 hours, and on August 9 the convoy moved fairly smoothly for 18 miles in 7¼ hours. Then the Moslem holidays of Id-al-Adha stopped the move for two days.

On August 10, the longest hours were run—10¾ hours—to cover 27 miles.

Location was reached at 8 a.m. August 12, after a 2-hour run of four miles. Thus, the actual moving time or pulling time, was 40 hours, though elapsed time, not counting the holidays, was about 5½ days—and no roads were traveled. On the contrary, some of the tractors were equipped with bulldozer blades so that impassable ground could be made passable. —**The End**

What Do Mounting Soviet Exports Mean?

Here's how this new source of crude could create an artificial surplus sufficiently large to threaten market stability in the West.

By VERITAS*

THE RISE in Soviet Bloc oil exports during the past few years, which, according to present indications, may this year surpass previous export peak of 123,000 barrels a day set by the Soviet Union in 1932, has caused justifiable concern among international oil companies.

Some quarters believe these exports will disappear one day from the international markets just as suddenly as they did in the years following 1932. However, the situation today is markedly different from that prevailing prior to World War II. Due to the introduction of the first Five-Year Plan in 1928, the Soviet Union was faced with two alternatives: re-

* Translated from Latin means "truth." Author, whose knowledge of Hungary qualifies him for the deductions and data herewith published, requests anonymity.

duce exports or slow down industrial development.

It chose the former. After World War II the Soviet Union came into possession of comparatively important oil resources in Central and Eastern Europe, which are being developed at a rapid pace. The rise in crude production not only in the Soviet Union but also in Romania, Austria and in synthetic oil production in Eastern Germany, has been noteworthy. It is also highly probable that substantial crude reserves have or will be discovered in China. That would further strengthen the Soviet position.

The free world underestimated the Soviet export potential of crude oil and products, which it mistakenly judged by western standards. The general belief was that even though increased crude production must be counted upon in the Soviet Bloc, such increase would most probably be absorbed by civilian consumption, long restricted to the bare minimum. There is no doubt, that had this been the case, there would have been no exportable surplus.

The free world still has not learned to judge every Soviet move in the light of the final Communist objective: destruction of the capitalist world. The renewed Soviet export drive signifies a change in method, but not in the aim.

Now that the possibility of successful military aggression has become rather uncertain, due to the preparedness of the West, Soviets switched to "economic" aggression from which they hope to benefit politically. The West must, therefore, count on their unrelenting efforts to upset the free world's economy by larger and larger exports of oil, etc. Negotiations with Iran having been concluded recently, the re-entry on the world markets of Iranian oil representing an ultimate 700,000 barrels a day is at hand. In retrospect, it becomes clear why the Soviet Bloc rushed to conclude as many trade agreements as possible in 1954 (more than 20) before a settlement is reached with Iran. Just to further embarrass the Free World.

Civilian use cut. Perhaps a further indication of Soviet intentions is that throughout the Soviet Empire, wherever possible, alternate sources of energy—coal, hydroelectric power, gas and even wood—are being used in preference to oil. Some quarters believe this may confirm a lack of oil and is a contradiction of claimed increases in crude production.

However, in view of the final Soviet objective mentioned, it is more likely that the USSR is saving all possible oil for export purposes.

Additionally, if Russia is to continue restricting civilian consumption to the present low level, it may create

TABLE 1

Soviet Bloc Exports for 1952-53 and Estimated Commitments for 1954

COUNTRY	1952 Bbls.	1952 Percent Industry	1953 Bbls.	1953 Percent Industry	1954 Commitments Bbls.	1954 Commitments Percent Industry
W. EUROPE and NEAR EAST						
Belgium & Lux.	300	.....	459,330	1.82	2,018,000	7.50
Denmark	54,050	0.37	2,950	0.02	328,000	1.83
Egypt	9,710	0.03	310	.....	2,602,000	7.86
Finland	1,682,720	32.09	4,773,650	80.20	5,789,000	87.47
(For Re-export)	.....	.....	.....	.....	4,210,000	.....
France	.....	.....	240,900	0.23	2,537,000	2.23
W. Germany	199,770	0.43	1,436,520	2.68	2,625,000	4.30
Greece	.....	.....	.....	.....	2,100,000	21.65
Iceland	.....	.....	317,030	13.98	1,470,000	62.55
Israel	.....	.....	.....	.....	1,393,000	17.10
Italy	2,603,770	5.38	2,405,400	4.17	4,487,000	7.11
Netherlands	3,880	.....	74,150	0.24	298,000	0.94
Norway	80,890	0.58	810,010	5.49	1,332,000	8.66
Sweden	.....	.....	1,934,500	4.77	4,436,000	9.97
Switzerland	15,480	0.16	59,620	0.55	706,000	6.01
Turkey	1,330	.....	2,330	.....	.....	.....
United Kingdom	.....	.....	.....	.....	70,000	.....
Sub-totals	4,651,900	1.28	12,516,680	3.11	36,401,000	5.97
Barrels daily	12,740	.....	34,290	.....	99,730	.....
OTHER COUNTRIES						
Argentina	.....	.....	.....	.....	7,281,500▼	11.30
Brazil	.....	.....	.....	.....	3,635,000▼	5.82
India	.....	.....	.....	.....	244,000	0.74
Totals	4,651,900	1.28	12,516,680	3.11	47,561,500	6.18
Barrels daily	12,740	.....	34,290	.....	130,300	.....

TABLE 2

Soviet Bloc Exports, by Country of Origin, for 1952 and 1953

1952 COUNTRY	Crude Oil	Products	Total	Barrels Daily	Percent
Soviet Union	1,171,000	845,900	2,016,900	5,526	43.36
Romania	.....	2,264,700	2,264,700	6,155	48.68
East Germany	.....	102,020	102,020	279	2.19
Other Satellites	.....	268,280	268,280	740	5.77
Totals	1,171,000	3,480,900	4,651,900	12,740	100
Barrels Daily	3,208	9,532	12,740	.....	.....
1953					
Soviet Union	1,168,530	3,564,490	4,733,020	12,967	37.81
Romania	.....	6,435,540	6,435,540	17,632	51.42
East Germany	.....	1,102,420	1,102,420	3,020	8.81
Other Satellites	.....	245,700	245,700	671	1.96
Totals	1,168,530	11,348,150	12,516,680	34,290	100
Barrels Daily	3,201	31,089	34,290	.....	.....

TABLE 3

Estimated Exportable Surplus Oil of Soviet Bloc for 1955, by Countries

COUNTRY	Crude Oil Production	Internal Consumption	Exportable Surplus-1955
Soviet Union	1,200,000 b/d	1,151,000 b/d	49,000 b/d
Satellites:			
Albania	6,000	2,000	4,000
Austria	91,000	33,000 (a)	58,000
Bulgaria	.....	7,000	(7,000)
Czechoslovakia	3,000	16,000	(13,000)
East Germany	50,000 (b)	12,000	38,000
Hungary	22,000	11,000	11,000
Poland	7,000	18,000	(11,000)
Romania	151,000	51,000	100,000
China	30,000 (c)	70,000	(40,000)
Totals	1,560,000 b/d	1,371,000 b/d	189,000 b/d

(a) Of this total, consumption of Austria represents 17,000 b/d; the balance of 16,000 b/d is estimated to be refined in Hungarian refineries on the Danube River and shipped mainly to Eastern Germany for use by the Soviet Army stationed there.

(b) Synthetic Oil Production.

(c) In China extensive geophysical and geological surveys are being carried on in various parts of the country and it is conceded that important discoveries may be made in the next few years. Whether these discoveries can be developed will largely depend on transportation facilities and the availability of drilling equipment, at present reported to be in short supply.

an artificial surplus sufficiently large to threaten market stability in some of the West countries, if not immediately, then in the future.

Few people have any idea of the extent civilian consumption has been cut in countries behind the Iron Curtain. In one country, the civilian population receives only five gallons of kerosine per family per year. It is used mainly for lighting homes. Cost per gallon may vary between $1 and $2.

One town with 40,000-50,000 population has no more than a dozen passenger cars belonging to Communist officials and the ubiquitous secret police, half a dozen buses for passenger transportation and a small fleet of trucks. A comparable U. S. town would have between 10,000-15,000 cars. Moscow, with a population of more than 4 million, has only about six service stations where civilian motorists can buy gasoline at 95 cents per gallon!

It must also be pointed out that the Soviet Union is building up its tanker fleet, which was estimated at 300,000 DWT at the end of 1953. Orders have been placed for 42 tankers of which 27 of varying sizes are being constructed in Finland and 15 of the ocean-going type in The Netherlands, Denmark and Sweden. It is not known how many additional tankers are being built in Soviet shipyards. At present, in any case, there is surplus shipping available that can be chartered at a low cost.

Rise in oil exports from 4.7 million barrels (12,740 barrels daily) in 1952 (see Table 1) to an estimated 48 million barrels (130,300 barrels daily) in 1954, is significant. It shows Soviet determination to recapture its former export markets. Whether the Soviet Bloc will be able to fulfill all 1954 commitments or whether the conclusion of so many trade agreements was just another propaganda gesture remains to be seen.

Analysis of Soviet Bloc exports, by country of origin, for 1952 and 1953, is shown in Table 2.

In 1952 and 1953, Rumania supplied about half of total exports. Growing importance of Eastern Germany as a source of product exports is also revealed (see Table 2), the increase in 1953 versus 1952 being approximately eleven fold.

This may be an indication of a considerably enlarged producing capacity of the synthetic oil industry in that Soviet satellite. While recently some crude oil discoveries have been reported in Eastern Germany, they appear too insignificant to have played any part in bringing about the increase.

Concerning 1954, it is currently impossible to give an analysis of the sources of Soviet Bloc exports, but it is estimated that out of the total of 48 million barrels, about 14 million barrels, or 29 percent, represent crude oil shipments to Argentina, Brazil, France, and Italy, as compared with 25 percent in 1952 and 9 percent in 1953.

It is estimated that in 1955 the Soviet Bloc will have an exportable surplus of at least 189,000 barrels daily, not counting synthetic oil production in the Soviet Union and Czechoslovakia approximating at least 32,000 barrels a day. It is also reported that Poland will have completed by 1956 the construction of its own synthetic oil industry, which may result in making that country independent from outside sources of oil.

Any Soviet Bloc success in bringing about a cut in crude price or production would seriously affect several countries—Venezuela and some countries in the Middle East dependent on oil revenue for budget financing.

Estimated exportable surplus oil of the Soviet Bloc for 1955, by countries, is shown in Table 3.

If the Soviet Bloc will be able to export at least 189,000 barrels daily, or 69 million barrels annually, in 1955 to the same countries as in 1954, it will represent about 8 percent of the estimated consumption of the countries affected.

The Bloc is operating mainly by trade agreements on a barter basis, most of which include an automatic renewal clause, and also some open sales through private importing firms. The situation is most favorable for the Soviets partly because of the prevailing dollar and sterling shortage in many countries and partly because of a surplus of manufactured goods, etc., which do not find ready markets except behind the Iron Curtain.

International oil companies have been placed in a particularly awkward position through Soviet Bloc exports. While they have resisted all attempts at dealing directly with the Soviets, in countries where government pools or monopolies exist, like in Finland and Iceland, there is no other alternative than to accept the Soviet Bloc oil supplies forced upon them by the government involved, and market them through their own installations. Otherwise, they would have to withdraw permanently from these markets.

As may be seen from Table 1 the Soviet Bloc expects to supply in 1954 about 87 percent of the Finnish market and 63 percent of the Icelandic market. Since war's end, major portion of these supplies came from the West, but dollar shortage and other conditions forced them into trading with the Soviet Bloc.

Finland, in order to fulfill its reparations obligations to Russia had to expand the manufacture of certain products, for which once the reparations payments ended, there was no market outside Russia. Thus, to avoid a possible economic dislocation by curtailing operations in its factories, Finland continued manufacturing the same products for Russia, taking oil in exchange.

In Iceland similar conditions prevailed. With return of the fishing fleets of the various European countries after the war, Iceland found no market for its catch of fish in the West. However, the Soviet Union was only too willing to exchange oil for fish, particularly in order to get a foothold in a strategic location—right in the middle of the West's Atlantic defenses.

In other countries with whose governments trade agreements have been concluded by the Soviet Bloc, some pressure is exercised at times on the major oil companies by the respective governments to assist in the marketing of Soviet Bloc oil products. Denmark and Egypt are good examples. In France the situation may become particularly serious.

The Franco-Soviet trade treaty limits importation of gasoline in 1954 to 850,000 barrels of which 70,000-80,000 barrels already have been delivered. Reports say this gasoline is of much higher quality than anticipated and that it is being sold about 20 per cent below established price. While the quantity is insignificant in itself, compared to total French consump-

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tion estimated at about 113 million barrels in 1954, the trade is concerned lest the French government may decide to base its internal retail price on the lower Soviet quotations, instead of Gulf prices as at present.

Then there are countries where private agencies with government approval undertake to import Soviet Bloc supplies. As Soviet products sell 10-15 percent below current market prices, the result is price cutting and loss of business to local marketing companies, unless they follow suit.

Western Germany and Switzerland may be cited in this category. In Western Germany certain jobbers have been buying oil products from the East Germany monopoly, but the Bonn Government has not been too satisfied with this method and is now putting pressure on the major oil companies for marketing East German products. In order to maintain market stability German companies intended to form a pool with participation by all oil companies for the distribution of Soviet oil imports. Due to existing anti-cartel regulations, this pool was not approved by the government.

The question arises as to what steps should be taken by the free world in order to counteract this latest move designed to upset its economy. It appears that the free world, having been taken by surprise by this Soviet attempt, has so far been unable to devise any constructive measures against it.

Several possible considerations include:

• **Propaganda.** This field must not be disregarded in efforts to counteract by all means at our disposal this latest Soviet move aimed at disrupting Western economy. The propaganda line must be carefully worked out, by countries, taking into account their historical background and local conditions presently prevailing and must be skillfully conducted in order to arouse the most dissatisfaction against the regime and Communist bosses. The West should be careful not to offend the sensibilities of people whose only aim is day-to-day survival. The program should not boast of two-car family garage, but rather point out to them how little their own government cares for their welfare; that it is selling abroad oil products at a low price, which would be badly needed at home; the exploitation of the masses by charging exorbitant prices for oil and other products; the contrast in the free world where oil supplies are abundant at a low cost, etc.

A forceful propaganda along these lines might compel the authorities to grant some increase in the rations. Even an increase of one gallon per person per year, would mean about 15 million barrels less oil for export.

• **Statistical organization.** So far at least, the free world has based its facts on the Soviet Bloc on conclusions rather than basing its conclusions on facts. The reason for this is, of course, that no serious effort has so far been made to obtain and disseminate reliable information on the Soviet Bloc's oil industry. This situation should be remedied as soon as possible.

The government or private industry, or both jointly, could establish an organization for the collection, evaluation and dissemination among those concerned of Iron Curtain statistics on oil and perhaps also on other sources of energy.

A private organization would be more flexible perhaps and could provide more efficient service than a government agency, which would have to work under certain handicaps. Sources of information are either already available or could be developed, the required talent is also at hand, and it would take only a coordinated effort to make such an organization a success, the importance of which both to national security and industry cannot be over estimated under present circumstances.

• **Diplomatic representations.** It would, of course, be unwise for the U. S. to exercise pressure on any government with a view to forcing a stoppage of trade with the Soviet Bloc, particularly when that trade consists of an exchange of goods for crude oil and products, unless some alternative to that trade can be offered.

Just what that alternative might be should receive high priority on the agenda of any discussion among the leaders of the free world. To do otherwise would only arouse ill will, which could easily be turned into anti-American propaganda by the leftist press.

However, in view of the liberalization of the list of embargoed goods recently effected, it will be difficult to divert trade from the Soviet Bloc as many of the items taken off this list have their natural outlet in the East. This development will not only strengthen the Soviet military potential in the long run, but it will also open the door to wider opportunities for Soviet Bloc oil exports. The Free World must, therefore, count on further substantial increases in these exports in 1955 and subsequent years, unless unforseen events intervene.

The West's immediate objective under these conditions should be to maintain at all cost market stability in all the countries of the Free World and diplomatic representations should be made to this effect with the respective governments. Unless the West succeeds in attaining this objective, it may be difficult to prevent chaotic conditions from developing which might adversely affect international oil trade.

• **Economic union of the Free World.** A recent development in economic planning of the Soviet Bloc should not be overlooked. Beginning with the sixth Five-Year Plan (1956-60) of the Soviet Union, Five-Year Plans of the Soviet satellites will be integrated with the corresponding plan of the Soviet Union. The first among the satellites to join on the new basis will be Czechoslovakia and Hungary. Other satellites, except Albania, which is slated to become a Soviet stronghold in the Adriatic Sea, will follow upon completion of their present plans. This will mean a coordinated effort for over-all development, instead of industrialization of the individual satellites with consequent duplication of many industries. It will also facilitate industrialization of China as the Soviet Union will be relieved from supplying raw materials, machinery, etc., to every satellite over long distances.

From a long range point of view, it appears that the free world must of necessity band together in forming an economic union to oppose the Communist colossus of nearly 800 million people with tremendous natural resources. It will be no easy task, but the foundations should be laid now, for a disunited free world has no chance of standing up successfully to an economically well-organized Communist bloc. —**The End**

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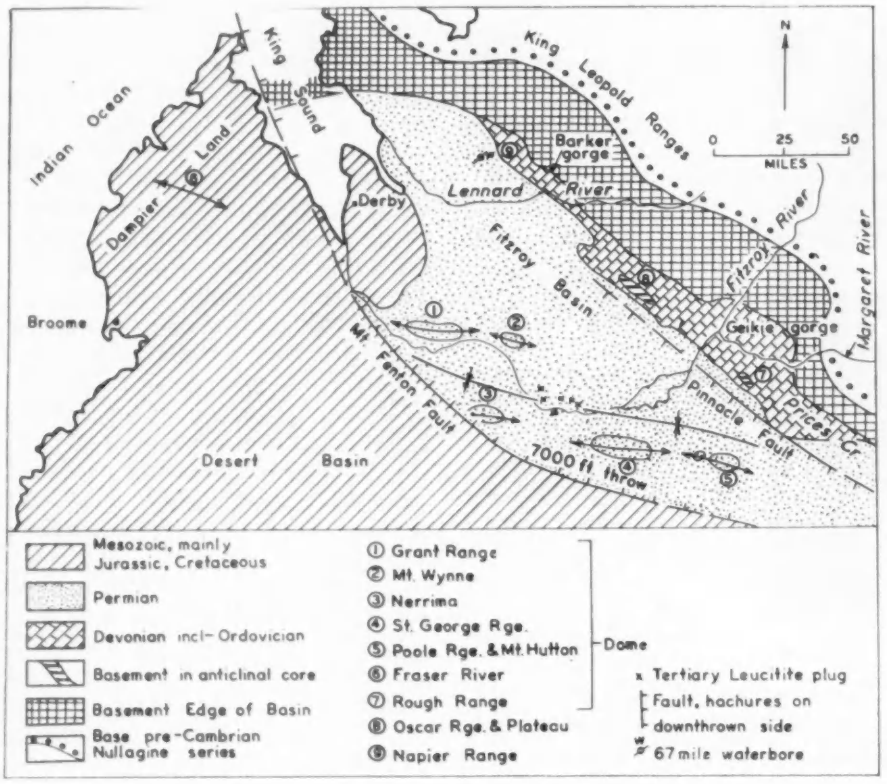

Fig. 4—Geologic map of Fitzroy Basin of Western Australia.

Area South of Mt. Fenton Fault Calls for Major Survey

If region is found to be deep basin, prospects will exist of much wider nature than Fitzroy proper can offer.

By DR. WERNER F. SCHNEEBERGER,
Anderson-Pritchard Oil Corporation, Denver

WHILE BOTH Cape Range and Giralia anticlines were considered targets for a first well, their size and shape raised doubts as to their being normal folds. On the author's recommendation, a detail gravity traverse was made, followed by two seismic reflection profiles which were shot across the Giralia structure by the Bureau of Mineral Resources, Geology and Geophysics.

In the gravity traverse, a marked minimum coincided with the surface axis. The seismic picture showed that the surface anticline in Cretaceous strata is underlain by a syncline in the young Paleozoic sequence and that, consequently, the anticline does not extend at depth. To the west these rocks showed a gentle rise, whereby the east-dipping, presumably uppermost Permian beds, are being truncated by the west-dipping Cretaceous section.

This is a typical case of the structural function of an eroded old land-surface over the morphologic highs of which the younger sediments were draped through differential compaction. Subsequent lateral compression caused the steepening of one flank. Similar conditions can be assumed for the Cape Range, although there, indicated by the strong northwesterly rise of the gravity values, the basement might be shallower. A seismic survey in the east flank to a point close to the axis failed to obtain conclusive reflections.

The stratigraphic-structural situation in the Northwest basin can be summarized as follows:

- Only formation in the young Paleozoic sequence which has certain characteristics of a source formation is the uppermost part of the Permian section.
- There is strong overlap of Mesozoic beds with favorable reservoir conditions, onto the Paleozoic sequence.
- Therefore, it is probable that oil formed in these Paleozoic source beds has accumulated in the Mesozoic reservoir beds.
- Structure, therefore, is purely coincidental with accumulation.
- Large-size structures might not extend to depth, but might, similar to Giralia, only be the expression of morphologic highs of a pre-Mesozoic land surface. If, however, for some reason geophysical evidence for such a condition cannot be obtained (Cape Range) prior to drilling, testing of such a structure is justified because of possible truncation of Permian source beds by Mesozoic reservoir rocks in favorable structural position.
- In the deepest parts of the basin, indicated by regional gravity minima, the Devono-Carboniferous formations might be developed in a more favorable facies, thus becoming prospective there.
- Geophysical methods are more important in the Northwest basin than surface mapping and should comprise regional gravity reconnaissance, detailed gravity work in se-

PART 2

This is the second part of an expert's geological appraisal of the oil possibilities of Australia. Part 1 appeared in the September issue of WORLD OIL.

lected areas, and seismic work on the most promising gravity indications and on all surface anticlines.

• Should absence of deep-seated folding be proved, then possibilities of fault traps as well as regional overlap possibilities between truncated younger Permian beds and overlapping Cretaceous should be investigated.

• It is evident from the foregoing that exploration of the Northwest basin, notwithstanding the early success, will be a long-range undertaking.

Forming the continuation of the Northwest basin to the south, through a narrow channel, is the Coastal Plain basin which extends to the south as far as Cape Leeuwin, the northwestern end of the Australian continent. Northern part of the Coastal Plain basin is also referred to as Irwin River basin, but is comprised here under the Coastal Plain basin.

Devono-Carboniferous formations have not been found yet, neither in that portion of the Northwest basin south of the Gascoyne River nor in the Coastal Plain basin.

As described by Clarke et al (1951), in the Coastal Plain basin the Permian section, although only 4000 feet thick, has a similar facies to that of the Northwest basin. It begins with glacial beds of Lower Permian age and ends with an alternating sequence of marine and nonmarine beds which partly indicate temporary land-locked conditions.

The Permian is overlapped by 800-1000 feet of Jurassic, 1000 feet of Cretaceous and 700-800 feet of Eocene sediments. Stratigraphic conditions obviously are quite similar to those in the Northwest basin. Here, also Permian beds with source formation characteristics are overlapped by Mesozoic sediments with good reservoir conditions. However, here, folding is absent, and prospects are restricted to either regional pinchouts of sands or fault traps in the Mesozoic section and the upper part of the Permian.

Structurally, the basin is a half-graben parallel to the coast, the pre-Cambrian western edge of which is largely submerged in the Indian Ocean.

A gravimeter profile made by the Bureau across the coastal plain at the locality Watheroo, showed a steep westerly gradient at the eastern edge of the basin, coinciding with the Darling fault, a pronounced minimum indicating the deepest part of the basin and a gentle seaward rise with the high values on the coast. Geophysical methods will be the main tools for the investigation of the Coastal Plain basin.

Fitzroy basin. The name Fitzroy basin is given preference to the former name of Desert basin because physiographically, as well as structurally, it forms a unit, even if future investigations should show that it actually forms part of Desert basin proper, i. e., of that area, which in the geological map of the Commonwealth of Australia is represented as a large basin.

The geologic history and consequently the stratigraphic record of the Fitzroy basin (see Figure 4) is in striking contrast to that of the Northwest basin. Its main characteristics are presence of rocks of Ordovician age, prolific development of reefs in Devonian time, absence of sediments of Carboniferous age and mainly terrestrial origin of part of the Permian sequence.

Discovery of Ordovician sediments by a Bureau geological party in the Prices Creek area, is of considerable geologic interest. The lower division of the Ordovician section (Emanuel limestone, 1670 feet exposed), alternating fossiliferous limestone, shale and marl, has the characteristics of a source formation, whereas the dolomite of the upper division (Gap Creek dolomite, 780 feet) has sufficient porosity for a reservoir rock. The known thickness of the Ordovician section is 2450 feet with the base of the Emanuel limestone not exposed.

The outcrop area of the Ordovician sediments in Prices Creek is approximately 12 square miles. As they have not been found at the surface elsewhere, it cannot be decided whether this important stratigraphic unit attains regional significance.

Three shallow bores were drilled in Ordovician rocks (then called Devonian) by Frency Kimberley Oil Company in 1922-23. Traces of oil have been reported from all of these bores. Rock samples from No. 1 bore were submitted to the government mineralogist and analyst in Perth, who said of his findings: "The oil yielded in each case was of a pale yellow color, with petroliferous odor and evidently of mineral origin."

The Ordovician is unconformably overlain by Middle Devonian limestone, which forms part of a wide belt of reefs near the Middle Devonian shore line along the northeastern margin of the basin. Greatest development of these reefs is to be found in the Margaret River area, i. e., in the southeastern part of the basin.

There, the Middle Devonian Pillara limestone attains a thickness of 2000 feet. The pre-Cambrian landsurface on which the Middle Devonian sediments rest, is in places quite rugged, the depressions filled by a sequence of rhythmically deposited nodular marl and limestone with a basal arkosic grit, and the highs capped by the lowest massive stromatoporoid reef limestone of the Pillara.

There is a marked change in thickness of the Pillara limestone in a northwestern direction. On the northeast side of the Oscar Range, it decreases from 2000 feet at Geikie Gorge to a few erosional remnants in the Napier Range and on the southwestern flank of the Oscar Range, partly due to overlap of Upper Devonian sediments and to widespread erosion in epi-Middle Devonian time.

In the Margaret River area, reef growth continued practically uninterrupted into Upper Devonian time (Mount Pierre Group) and reached a second peak in Bugle Gap time. The red limestone-siltstone sequence with *Goniatites* sp. of the Mount Pierre Group represents inter-reef facies of contemporaneous reefs and is seen interfingering in many places with the actual reef facies. Upper Devonian sediments in this area attain a thickness of 3000 feet.

A peculiar feature is the J8 conglomerate, so called after a trigonometric station. In the outcrop it forms masses of loose or poorly cemented, water-worn boulders and pebbles of pre-Cambrian rocks at the landward side of the Upper Devonian reefs, in channels within the reefs, and as sandy conglomerates on the seaward side. In places they interfinger with clastic reef limestone and marl. Although their main distribution occurred in Mount Pierre time, influx of coarse clastics continued in Bugle Gap time. In the author's opinion, J8 conglomerate is a piedmont de-

posit close to active fault scarps in the vicinity of the Devonian shore.

On Oscar Plateau and in Napier Range, Upper Devonian is developed in two distinct formations, and in a different facies from that of the Mount Pierre and Bugle Gap formations.

Napier formation, 2000 feet thick on the Oscar Plateau, 950 feet at the Barker Gorge, in its lower portion is essentially clastic and arenaceous. It contains angular fragments of Pillara limestone and pre-Cambrian rocks, evidence of strong erosional processes, possibly in connection with uplift in this area. Only in places could reef organisms establish themselves for a short time, building scattered bioherms throughout the section.

More stable conditions were reestablished in Upper Napier time, when large reef masses formed in several areas (Lennard and Barker River). Along the southwestern flank of Oscar Range, Upper Devonian limestones attain a thickness of 1500 to 2000 feet.

Fairfield formation, which may represent the basinward facies of the Napier formation, consists of silty and sandy limestone and marl.

Similar to the J8 conglomerate of the Margaret River area, local accumulations of coarse clastics occur as Mt. Behn and Mt. Patterson conglomerates.

Summarizing Devonian stratigraphy, it can be said that two areas can be distinguished—comparatively stable Margaret River area, with maximal development of reef growth and absence of a pronounced hiatus between Middle and Upper Devonian and the unstable northwestern area (Napier Range, southwestern flank of Oscar Range), where erosion in epi-Middle Devonian time has removed part of the Middle Devonian sediments.

Here, hiatus between Middle and Upper Devonian is greatest and overlap of the Upper Devonian sediments onto remnants of the Middle Devonian limestone strongest.

Basinward, Devonian reef limestones are overlapped by Permian sediments. Therefore, their distribution over the deeper parts of the basin is unknown. By virtue of their nature of a fringing reef on a subsiding shelf, it can be assumed they are restricted to the immediate vicinity of the ancient shore line. They may merge basinward into a deeper water facies. In the 67-mile artesian well Middle Devonian is missing and Upper Devonian only is preserved. However, this might be more in connection with epi-Middle Devonian erosion than non-deposition.

It is possible that in deeper parts of the basin around and over basement highs in the Devonian sea, reef-growing organisms had established themselves and that fringing and capping reefs were formed. Such basement highs can be expected to coincide with major structures.

The Permian section is approximately 7000 feet thick. About half of it is occupied by the terrestrial, glacial Grant formation, the equivalent of the Lyons in the Northwest basin. The other half comprises Poole sandstone (200 to 1200 feet of sandstone and conglomerate with neritic fossiliferous Nura-Nura limestone at base), Noonkanbah formation (1200 feet of marine sandstone, fossiliferous siltstone and conglomerate) and Liveringa formation (1200 feet, estuarine sandstone and siltstone).

To the west and south, the Permian is overlain unconformably by Jurassic marine and freshwater sediments, which near the coast are overlapped by plant-bearing sandstone of possible Cretaceous age.

Structurally, Fitzroy basin is a graben or half-graben, bounded to the southwest by the Mount Fenton fault and to the northeast by the reef-supporting shelf. In the eastern part of the basin, the reef front is displaced by the Pinnacle fault bringing Ordovician in contact with Permian Noonkanbah immediately south of the fault.

The Mt. Fenton fault, a major structural line, trends approximately northwest. Its continuation along the east coast of Dampier Land is conjectural, but supported by morphologic indication. Bureau gravity traverses across the fault indicate an estimated down throw of 7000 feet to the northeast.

Five major domes are arranged along two parallel trends which cross the basin obliquely. The trends are separated by a regional syncline with Tertiary Leucitite plugs in its deepest part.

The southern trend comprises Poole Range, St. George Range and Nerrima domes, northern trend Mt. Wynne, and Grant Range domes.

These anticlines are intensively faulted, especially in their flanks, but many faults, frequently hinged and double-hinged, cross the axes in a dense pattern. Only in Mt. Wynne and Grant Range domes are the faults arranged more or less in strike. In the author's opinion, the cross-fault pattern was caused by compaction of the competent sandstones over pre-Cambrian buried hills.

Poole Range dome is the easternmost structure on the southern trend. It is a faulted dome with definite closure to the east and has Grant sandstone exposed. To the west, there is a secondary structure—Mt. Hutton. Closure toward St. George Range dome is indicated and might be enhanced by a major fault. Because of its proximity, about 15 miles, to the nearest outcrops of Ordovician and the Devonian reefs and because of oil shows in Grant sandstone in

About the Author

DR. WERNER F. SCHNEEBERGER is research geologist with Anderson-Prichard Oil Corporation in Denver. From 1926 to 1948 he was exploration geologist for the Royal Dutch-Shell Group. His last assignment was the direction of Shell's exploration in the montaña of Peru in 1945-1947. In 1948 he left Shell, studied at the University of Berne, Switzerland, for two years, joined the Bureau of Mineral Resources, Geology and Geophysics in Canberra, Australia, as superintending (petroleum) geologist. He directed the bureau's exploration of the sedimentary basins of Western Australia. In 1952 he assumed his present position. He is a member of American Association of Petroleum Geologists, the Swiss Geological Society and a Fellow of the Geological Society of London.

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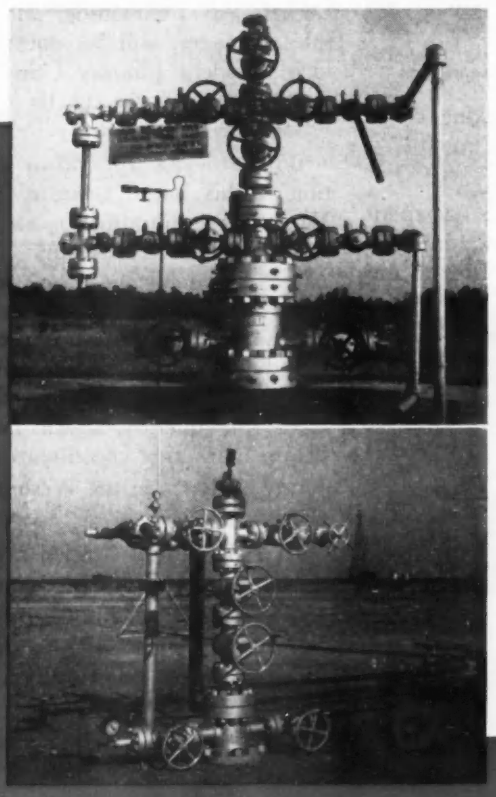

The moral here is, that standard W-K-M Valves will stand up under sour crude service — but, a check on the type of crude is often wise before installing valves for permanent service, as the use of proper trim at the beginning can prevent an emergency shutdown later. Also, as a general practice, it is well not to switch valves from field to field without making sure that the trim is suitable for the service.

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Bore No. 3, this structure deserves first consideration as a drilling objective, although it is the farthest from the coast.

St. George Range dome is a larger structure than Poole Range, but similarily transected by faults. It undoubtedly has a greater closure, but is difficult of access.

Grant Range anticline is at least 25 miles long and 10 miles wide between the Noonkanbah/Liveringa contact in either flank. It has Grant sandstone exposed and is complicated by a series of strike faults, one of which has considerable throw. It is about 60 miles southwest of the Devonian reef outcrop of Oscar Range.

Nerrima, an elongated dome about 16 miles long and 8 miles wide, shows a crossfault pattern similar to the large structures. Western closure is complicated, possibly because of its proximity to the Mt. Fenton fault. Eastern closure is established at the surface. A recent seismic survey by the Bureau failed to establish the structure at depth. Nerrima 1 bore was abandoned at 4271 feet in Grant formation. There are plans by Freney Kimberley Oil Company to drill a second well.

Mt. Wynne dome is about ten miles long and wide and extremely faulted. Asfaltic matter in fissures of Grant sandstone was reported from the well drilled on this structure. Mt. Wynne is too complicated to be considered for a first test.

Although surface mapping is completed, there remains a great deal of geophysical work to be done before drilling.

A major problem to be investigated by geophysical methods is the nature of the vast area south of the Mt. Fenton fault. Should it be a deep basin, prospects are of a much wider nature than the Fitzroy basin proper can offer.

Should the area, however, be underlain by shallow basement with a thin Permian-Mesozoic section, then prospects would be restricted to the Fitzroy basin proper. Caution should be exercised in the interpretation of seismic records in the Desert basin, because great thicknesses of sediments recorded might be represented there by the non-prospective Upper pre-Cambrian Nullagine series, simulating the presence of a thick Paleozoic section. **End Part 2.**

What's Happening

AMONG WORLD OIL MEN

Houston Nomads Entertain Visitors

Recent visitors at a meeting of the Houston Chapter of Nomads were, front row left to right, J. L. Lloyd, Shell Oil Company, Venezuela; C. J. Pinner, Shell Oil, Venezuela; G. A. Stout, Continental Supply Company, Houston; and C. A. Froitas, Cities Service Oil Company, Lima, Peru. Back row, left to right, are Johnnie White, Glenn McCarthy, Inc., Houston; T. G. Shad, Asiatic Petroleum Corporation, New York; W. C. Neale, Drew-Leduc Oils, Ltd., Houston; and A. Nilsson, Asiatic Petroleum, New York.

THOMAS REIS, former assistant to the general manager of the French Petroleum Institute and associate professor at Ecole Nationale Superieure du Petrole, now a partner in a French consulting engineering firm and independent research organization, is visiting in the U. S. Reis made the trip on behalf of several French companies seeking U. S. manufacturing license agreements.

Thomas Reis

•

FRED H. BILLUPS, who has spent 26 years with the Jersey Standard organization, will become president and chief executive officer of Tropical Gas Company, a newly-formed company, effective October 1 upon his resignation from Esso Standard Oil, S. A., an affiliate of Standard Oil Company (New Jersey), with headquarters in Havana, Cuba. He will succees R. T. HASLAM, a former vice president and Jersey Standard director, and will be based in Miami, Fla., international headquarters of Tropical Gas.

F. H. Billups

L. J. BREWER, Esso Standard director, will succeed Billups, with headquarters in Havana.

H. P. BLACKEBY, present chairman of the board of directors of Esso Standard, will resign January 1, 1955, to retire that year. A. C. FISCHOFER, a board member and general sales manager, will become executive vice president January 1 and assume some of the duties to be gradually relinquished by Blackeby.

Billups began work in an Esso station in his home town of Norfolk, Va., after graduating in engineering from Virginia Polytechnic Institute. After advancing in Esso's domestic sales organization, his responsibilities expanded with the parent company as advisor to Jersey's affiliates in Europe, North Africa, and the Near East. Subsequently, he was named assistant marketing coordinator also for Jersey affiliates in the Western Hemisphere.

In 1951 Billups headed a group to study a merger of operations of six Jersey affiliates in the Caribbean and Central America area, resulting in merger of operations into Esso Stand-

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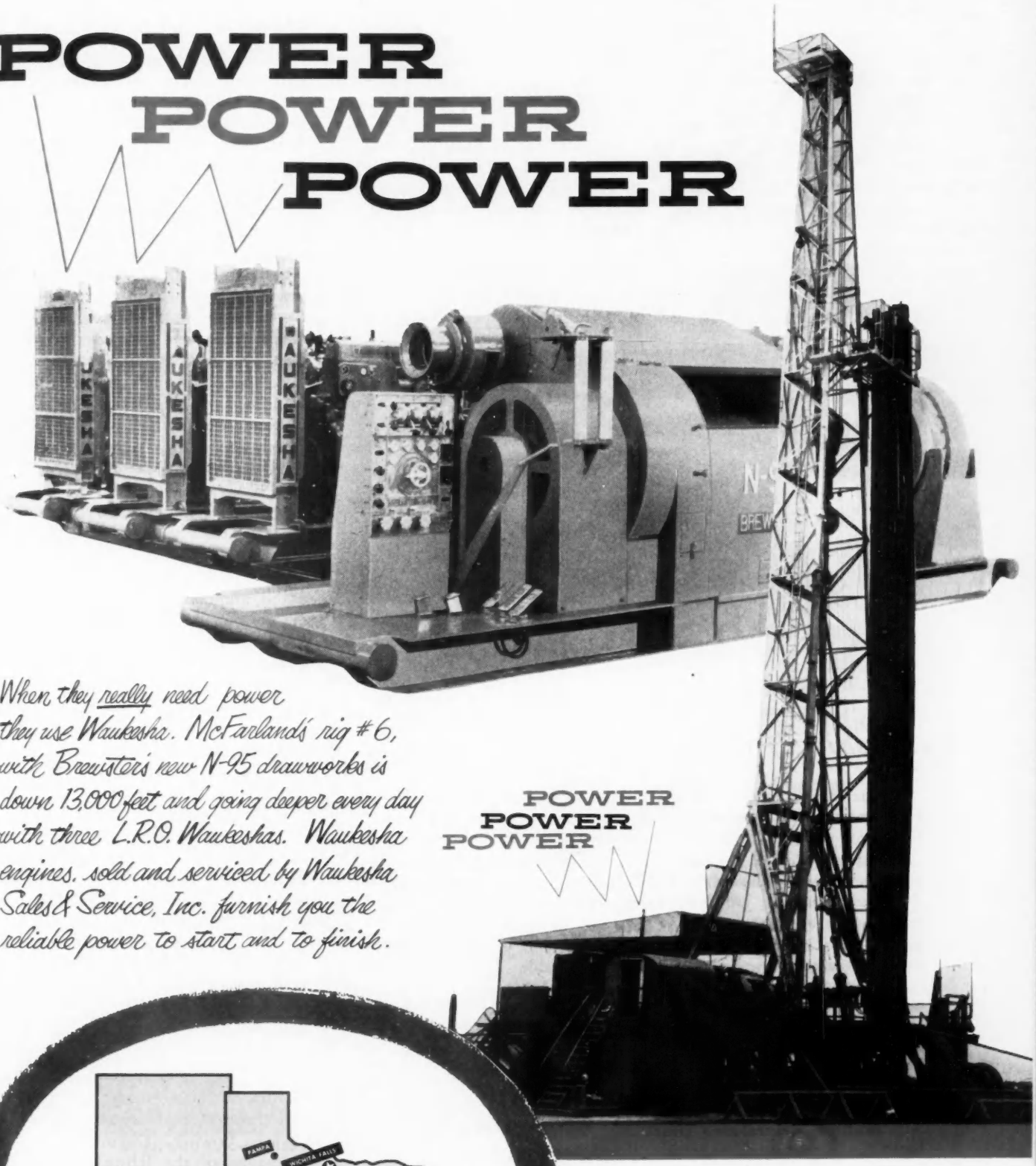

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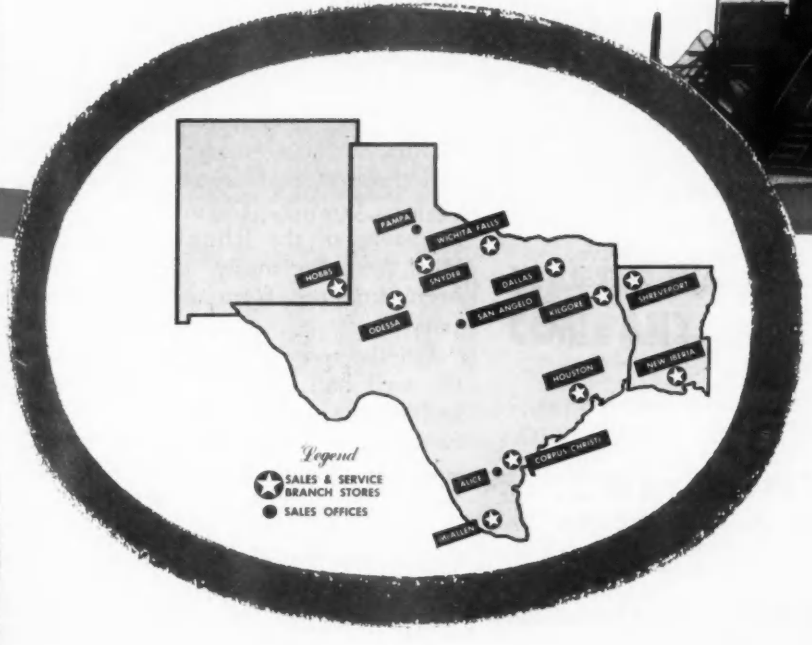

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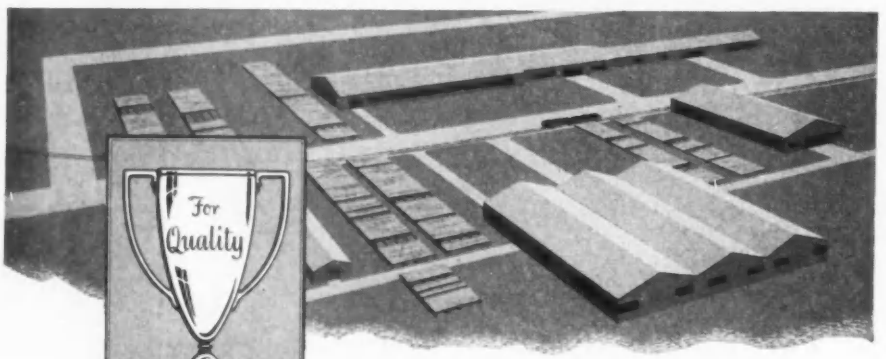
ard Oil, S.A., in Havana, with Billups its first president, a post he has held since 1952.

Brewer, with 17 years experience in Aruba before going to Cuba in 1947 to the Esso Belot refinery, eventually became president of Esso Standard Oil (Cuba). Soon after that company merged with Esso Standard Oil, S.A., he was elected director of the latter company.

Blackeby will end his company career after 33 years with Esso interests, largely in financial and accounting fields. He left his post as assistant comptroller of Jersey Standard to go to Havana at the time of consolidation of operations of six Esso affiliates in the Caribbean and Central American area, and has been board chairman since.

Fischofer joined Esso Standard Oil in the international office in Cuba late in 1951 as board member and general sales manager. He entered the Esso sales organization in the U. S. in 1924, and later joined the parent company, Jersey Standard, where he has held various executive positions in its world-wide operations.



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Expanded Drilling Efforts Follow Mexico Discovery

Impressive data on Mexico's new Miguel Hidalgo field in Veracruz has been released by Antonio J. Bermudez, director of Petroleos Mexicanos, the government owned oil monopoly.

Hidalgo 1, which came in at 7685 feet with a production of 3500 barrels per day, is strategically close to already existing transportation facilities. It is less than a mile from the beach at Tecolutla and 200 yards from the asphalt Mexico City-Tecolutla highway. Refineries at Poza Rica are only 36 miles away.

A line of 14-inch pipe is already being laid the 15 miles to the Ezequiel Ordoñez field, where it will make connection with a pipe line to Poza Rica that is now operating.

It was expected that production from the Miguel Hidalgo field will be in Poza Rica refineries by September 15.

Drilling has begun on Hidalgo 2 and 3, and new rigs are being brought in to expand operatio s. Chief of Pemex engineers, Augistín Straffon, estimated that within a year the Tecolutla structure would have 25 wells delivering not less than 70,000 barrels a day, an amount equal to half the total production of the entire Poza Rica district. He said that the crude from Hidalgo 1 was very light, "almost gasoline."

A promising adjacent structure is being tested with the drilling of Allende 1. The site is on the Tecolutla beach, a hundred yards from the Gulf of Mexico.

Second Producing Pay Is Found at Weingarten

A second producing horizon has been discovered in Germany's Weingarten field. The well Weingarten T. 1, drilled by C. Deilmann Bergbau GmbH. in behalf of the joint interest Deilmann-Dea-Wintershall, has discovered flowing production in the sandstone of the Rhaetic at 3600-3610 feet. Previously, the field had been produced from only the Tertiary.

On the western flank of the field, the well had encountered oil traces in the Dogger and Liassic. Flow tests from the "Steinmergelkeuper" resulted in a final flow of water. But flowing production of 170 barrels a day through 1/8-inch choke was obtained from the Rhaetic sandstone.

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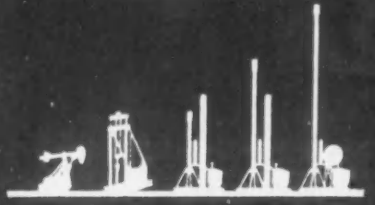

Pelton's complete line of hydraulic pumping equipment range in size from 10,000 to 40,000 Lb. polished rod load rating and stroke lengths from 48 inches to 30 feet.

FOUR OF THE FIVE OFFICERS of the 1954 Permian Basin Oil Show are holding miniature paper derricks used in publicizing the show. Standing are W. D. Lane, Midland, independent oil operator, left, and Carlos Clover, Odessa, secretary and general manager. Seated at left is Joe T. Dickerson, recently-named president of Shell Pipe Line Corporation and whose transfer to Houston is effective October 1, and C. M. Foster, Gulf Oil Corporation, recently transferred from Odessa to Wichita Falls. Alternates for Dickerson and Foster are John E. Cooper, Western Company, Midland, and Garnett Plank, Kewanee Oil Company, Odessa.

Permian Basin Oil Show Ready for Oct. 14-17 Run

Some 400 exhibitors and an attendance of more than 150,000 are expected.

ABOUT 400 exhibitors and more than 150,000 attendance are expected at the 1954 Permian Basin Oil Show in Odessa, Texas, Oct. 14-17.

This third edition of the biennial show, which was built as the "oilfield worker's show," will feature indoor and outdoor exhibits of products pertaining to oil and ranging from tanks to tubing, from drilling barges to drilling bits.

A special feature of the exposition —a non-profit corporation—is expected to develop into a permanent landmark on the American oil scene: it is a "Boom Town" complete with the old-time, false-fronted buildings, a mule-drawn ferry across muddy streets, ancient tools and equipment, as well as some of the industry's first rolling stock.

"Boom Town" is expected to be largely temporary for this year's show. However, tools and equipment gathered for the show and the interest which already had been generated will be used to work toward a permanent brick or stone structure and a national rating for the Permian Basin Oil Museum.

Some equipment lined up for this year are early day "soup" wagons for explosives, old-time trucks, a regular old wooden derrick, a cable tool drilling rig, and one of the first rotary drilling tables manufactured.

Sufficient room for staging this show and for future expansion of the museum's buildings and grounds is assured at the 66-acre site. Now nearing completion on the show grounds is the Ector County Coliseum, a mammoth steel-and-brick structure rising 80 feet above ground. It seats more than 9000 persons.

The exposition and museum are both well placed. Situated in the heart of oil fields, more than 20 big rotary drilling rigs can be counted from atop the coliseum. The immediate area has been a producer of oil for more than 25 years.

All phases of the American oil industry will be represented: exploration, drilling, production, transportation, refining, and marketing. Exhibits will include working models and scale models, cutaways, actual field type installations, photographs, slides and moving pictures and descriptive literature.

Oil men's associations active in the Permian Basin will meet immediately before or during the exposition. They include American Petroleum Institute, American Association of Oilwell Drilling Contractors, Association of Desk and Derrick Clubs of North America, American Institute of Mining and Metallurgical Engineers, National Association of Corrosion Engineers, Instrument Society of America, West Texas Geological Society, and others.

An attendance of about 20,000 is expected at the Saturday night barbecue, Oct. 16. Serving will be handled by the Odessa Chuck Wagon gang, which served more than 15,800 at the 1952 show in about an hour and 15 minutes. A special Texas-sized bean pot, manufactured especially for the show by Sivalls Tanks, Inc., will be used to cook hundreds of pounds of beans for the big feed.

A major attraction at the show will be the Tobin Aerial Surveys photo map of more than a fourth of the U. S. The map, 49 feet wide and 139 feet long, covers the country from the Arizona-New Mexico border to the Atlantic, from Kansas to the Gulf

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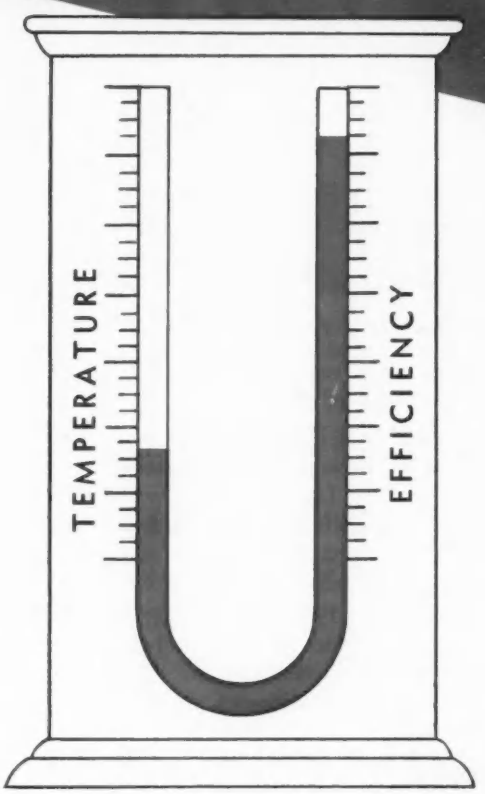

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SHOW DIRECTORS, Tom Brandon, left, and F. A. Knight, go over a plot plan of the grounds for the 1954 exposition. Brandon is one of two exhibits committee chairmen. Knight is in charge of over-all entertainment.

SHOW SECRETARIES Pat Wallner and Nallda Tisdale of the general offices hold some of the contracts signed by show exhibitors. Banner in the background is used at official functions of the show.

of Mexico. Another part of this exhibit will be aerial photo maps of individual counties around Odessa.

The Oil Show dates coincide with Oil Progress Week, a national observance sponsored by the Oil Industries Information Committee of API. Progress Week activities of the show will include a downtown parade on opening day, designation of opening day as Youth Education Day, announcement of winners of a $1000 essay contest, and showing of free OIIC oil industry movies. The essay contest is conducted annually by the West Texas Area of OIIC, with the Oil Show giving the prize money.

Subject of all essays this year is "The Oil Industry's Role in the American Way of Life."

Exhibitors will begin moving in heavy equipment early in October. At least six drilling rigs and portable masts are committed for the show.

Improvements over last year's show include more space for both exhibits and parking, in addition to an increase in hotel space.

Bell Aircraft Corp. has donated a helicopter for full-time ferry service between the three Odessa and Midland airports and the show grounds. Entertainment will feature stage and screen actors.

KEEPING POSTED. Examining one of the large animated posters used in publicizing the oil show are, left to right, Emile Robin, San Antonio, representative of National Decorators, the firm which will "dress" the 1954 Permian Basin Oil Show; Harold Downs, partner in the steel fabricating firm of Downs-Clark, Inc., and mayor of Odessa; Roy Carter, Carter Foundation Production Company, Kermit, Texas, a vice president of the show, and Henry van dePutte, also of National Decorators.

A special attraction will be the opening day wildcat dinner for executives at $10 a plate. The program will be a panel discussion on "American Policy and the Oil Industry." Moderator will be Dan Smoot, Facts Forum program moderator.

W. D. Lane of Midland, veteran Texas oil man, is president of the board of directors of the show. Other officers are:

Roy Carter, Carter Foundation Production Company, Kermit, vice president; Joe T. Dickerson, Shell Oil Company, vice president; Charles Foster, Gulf Oil Corporation, Wichita Falls, treasurer; and Carlos Clover, Odessa, secretary-manager. The board represents producing companies, drilling contractors, supply firms, and manufacturers from Odessa, Midland, McCamey, Big Spring, San Angelo, Hobbs, N. M., and other West Texas and New Mexico oil centers. —**The End**

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What's Happening

AMONG MEN IN THE INDUSTRY

R. E. Heithecker, formerly with **Seaboard Oil Company,** has opened a consulting office at 6103 Martel Avenue, Dallas. He will work as a consulting engineer in the fields of petroleum and natural gas. A graduate of Purdue University, Heithecker was with the Bureau of Mines in Bartlesville, Okla., from 1926 until 1945. Since 1945 he has been with Seaboard in the Natural Gas and Reservoir Engineering departments in Dallas.

R. E. Heithecker

•

Marvin E. Frankamp, district geologist for **Bishop Oil Company** in Kansas, has resigned to become an independent consultant.

•

Lorne E. Tjernagel, has been transferred by Shell Oil Company from its Bakersfield, Calif., office to geological offices in Oklahoma City.

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Horne Well Service Co. - - - - - - - - 3-5396

HOUSTON
Adair Service Co. - - - - WE-6497, HU 6-3462
Tuboscope - - - - - - - - JU-0577, MO-4279

MIDLAND
Luccous - - - - - - - - - - - 4-8471, 4-4320

NEW IBERIA
Tuboscope - - - - - - - - - - 2-3831, 4-1327

OKLAHOMA CITY
Rainbo Service Co. - ME 4-2131, ME 2-3045

WICHITA FALLS
Hudson-Eads, Inc. - - 2-3767, 2-8584, 3-4690

T. S. Gay, vice president and assistant secretary of **Phillips Petroleum Company,** was named director to fill the vacancy created by the resignation of **Eugene E. Dupont,** who completed 35 years of continuous service as director.

•

The Texas Company has appointed three new departmental general managers. **Dr. Wayne E. Kuhn** is named general manager of the Research and Technical department; **James V. C. Malcolmson,** general manager—Marine department; and **Theodore A. Mangelsdorf,** general manager of Refining department.

•

Bruce Scrafford has been elected to the presidency of **Highland Oil Company, Esperado Mining Company** and **Frio Pipe Line Company,** according to an announcement by the boards of directors of the three companies. Headquarters are in the San Jacinto Building, Houston. Scrafford has been vice president of the Highland Oil Company since June 1, 1952 and his election as president of the three companies followed the resignation of **Virgil A. Brill.** Scrafford will also serve as general manager of the Herman Brown and George R. Brown Oil Division.

At the same time the boards of directors announced that **Robert D. Hendrickson,** former chief geologist with Highland, has been advanced to vice president of the three companies.

Russell W. Holman

Emil J. Faseler, Jr.

Russell W. Holman of Houston has been promoted to production manager of **D. D. Feldman Oil and Gas,** Dallas-headquartered independent operator. Holman succeeds **J. E. Hooper,** who has become special assistant to D. D. Feldman. In Houston **Emil J. Faseler, Jr.,** will succeed Holman as Production department supervisor for the Feldman organization's Houston district, supervising production activities in the Texas and Louisiana Gulf Coast areas. Holman, who has been with D. D. Feldman since June 1951, was employed by The Texas Company for 11 years, gaining field operations experience in several South Texas oil fields and serving for five years in the reservoir engineering section of the company. He resigned as division reservoir engineer for the company's South Texas division to join D. D. Feldman Oil and Gas. Faseler joined the company after nine years with Humble Oil & Refining Company in South Texas. Hooper has headed the D. D. Feldman Oil and Gas Production department since joining the organization in 1936. He has been active in the oil industry since 1908. In 1921 he became superintendent of production for the Gulf Coast division of the Sinclair Oil and Gas Company, holding that position for 12 years. Hooper joined the Feldman organization after several years as an independent drilling contractor.

•

Associated Oil & Gas Company has announced the appointment of **Z. C. Ambrose** as assistant president. Ambrose has assumed his administrative duties in the oil and gas producing and Associated Oil Field tool rental divisions. Formerly Ambrose was vice president and manager of Southwest Gas Producing Company and Carbons Consolidated, Inc., and was president of Monla Gas Company, Inc., all of Monroe, La. He served as director of these companies and of the parent company, Commonwealth Gas Corporation, headquarters in New York. Prior to 1947 Ambrose was associated with the Gas and Gasoline division of the Chicago Corporation and with Continental Oil Company.

Z. C. Ambrose

•

Robert L. Whiting has been named head of the Department of Petroleum Engineering at Texas A. & M. College and **Dan M. Bass,** assistant professor of petroleum engineering.

Before coming to A. & M., Whiting was a reservoir engineer with Stanolind Oil and Gas Company in Tulsa. He holds bachelor's and masters' degrees from the University of Texas.

Bass, a graduate of Louisiana State University, worked for the past two years on oil recovery problems for the Texas Petroleum Research Committee.

•

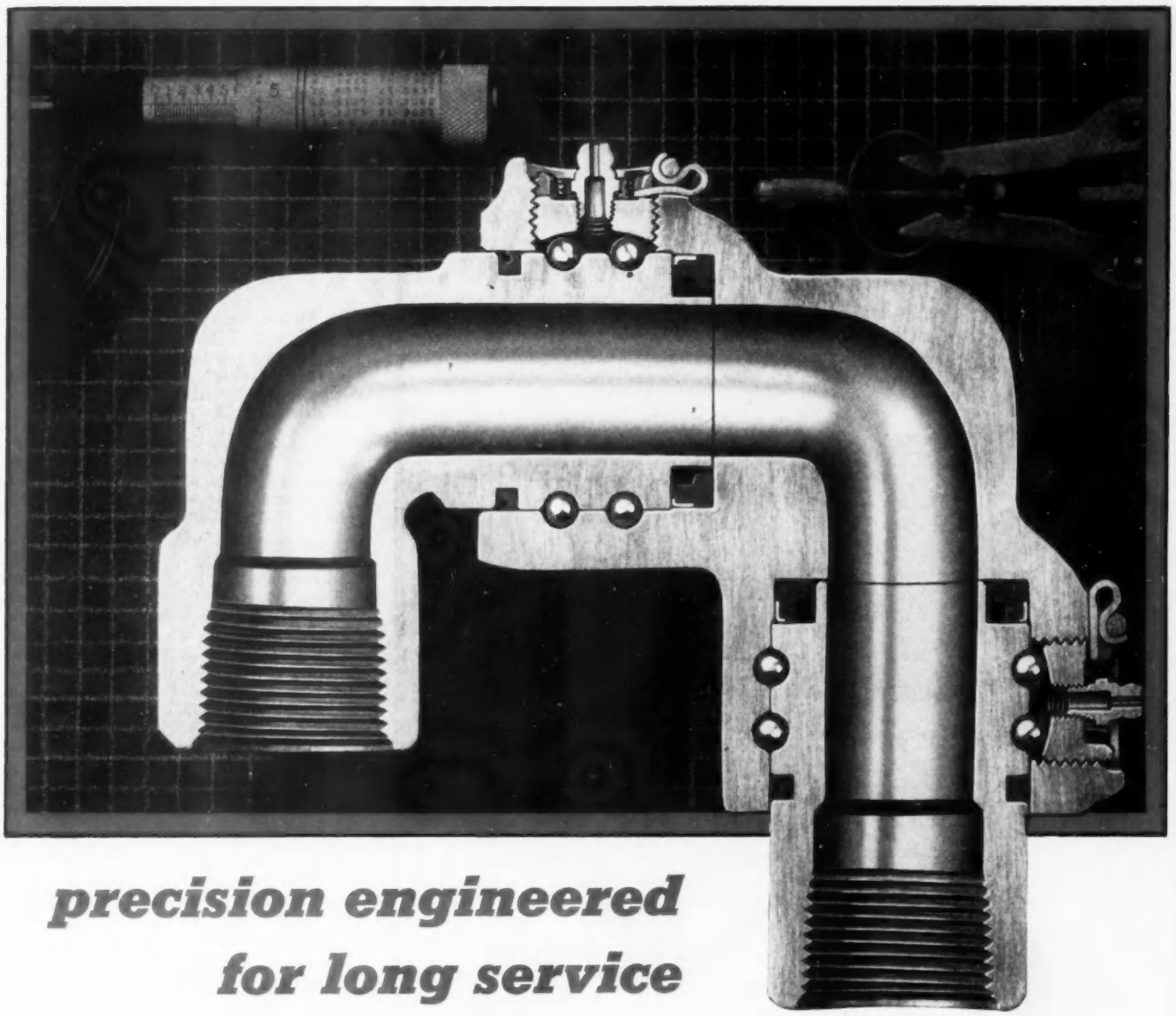
O. N. Miller has been appointed a vice president of **Standard Oil Company of California.** Miller, who has been general manager of Standard's Manufacturing department for the past eight years, came to work for the company in 1934.

•

J. Peter Smith, member of the Geological department of **The Carter Oil Company,** has resigned to become an independent oil producer and geological-engineer at Carmi, Ill.

•

Standard Oil Company of California has appointed **E. J. McClanahan** as vice president and director of western operations. In this capacity McClanahan will have responsibility for operations of the company in the seven western states, Alaska and Hawaii.



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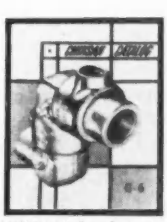

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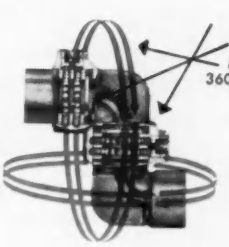

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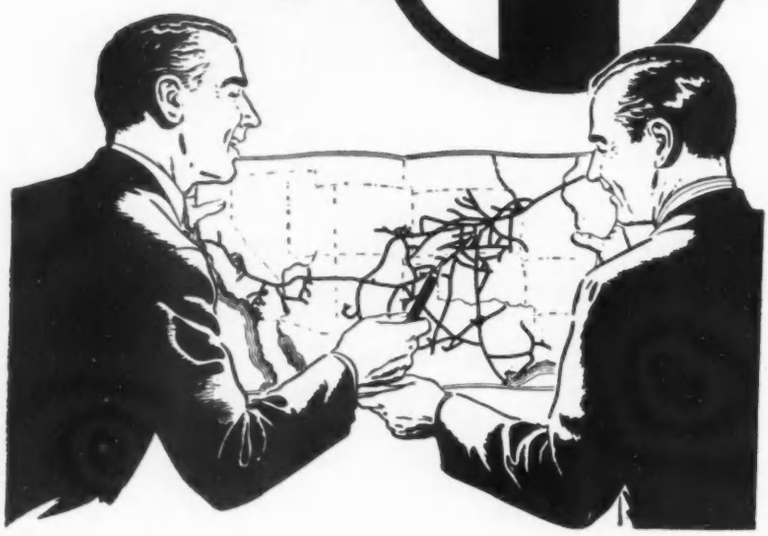

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O. F. Moore

John R. Donnell

O. F. Moore, who in his career of nearly 45 years with **The Ohio Oil Company** advanced from stenographer to a director and vice president in charge of the company's supply and transportation activities, has retired.

John R. Donnell, assistant manager of the Supply and Transportation department, has been elected a vice president and director, and appointed manager of the department succeeding Moore.

Moore went to work for Ohio Oil in 1909 as stenographer in the Robinson, Ill., field production office, and a few years later was transferred to the general office, Findlay. He was appointed assistant secretary of the Illinois Pipe Line Company following its organization in 1915 to acquire and operate the pipe line facilities of Ohio Oil. He served as vice president of Illinois Pipe Line from 1938 until the subsidiary was dissolved and its functions reabsorbed by the parent company in 1943.

A year later Moore was advanced to assistant manager of Ohio Oil's Pipe Line department. In 1946 he was appointed manager of the department and was elected a director and vice president. On January 1, 1954, he became manager of the newly created department embracing the company's operations in the transportation and supply of crude oil and refined products.

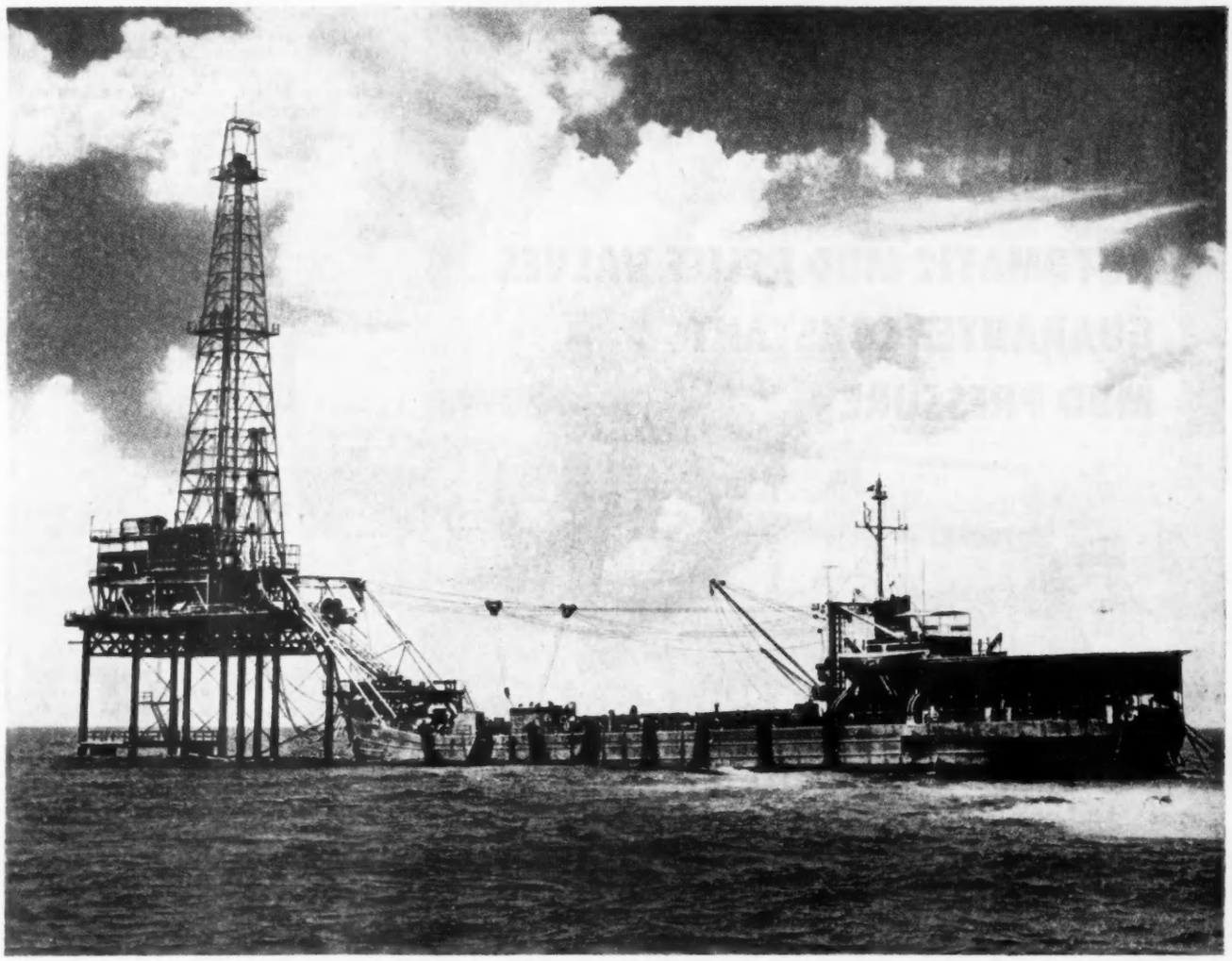
Donnell joined The Ohio Oil Company in 1936 as a special representative in the executive offices. In 1944, he became assistant to the manager of production, and in 1950 was elected treasurer of the company. He served as treasurer until this year, when he was appointed assistant manager of the Supply and Transportation department.

•

Dr. Arthur C. Munyan has been transferred to the Billings office of **Sohio Petroleum Company** as staff geologist. He will oversee all geological staff work in the Northwest division. **Jack H. Walters** has been transferred from Sohio's Tyler, Texas, office to the Casper district where he will be district superintendent of operations. Walters replaces **Clayton W. Nygaard**, who was transferred to Sohio's Russell, Kansas, office in the Mid-Continent division.

•

Lion Oil Company has announced personnel additions within the Rocky Mountain region. **Roger D. Sears** has joined the staff of the Bismarck, N. D. district office as junior geologist and **Bernard V. Berardini** has been employed as junior landman in the Casper, Wyo., district office. **Joseph A. Larkin** is in the Colorado production district office at Fort Morgan as senior clerk. Other personnel changes include **James C. Booth**, advanced from production foreman to production superintendent



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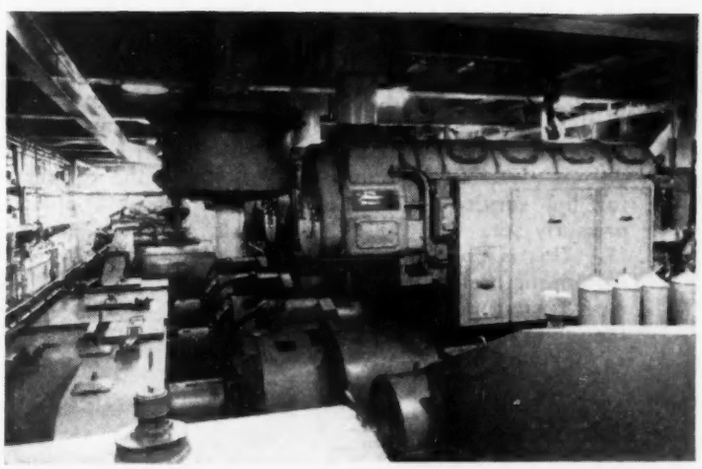

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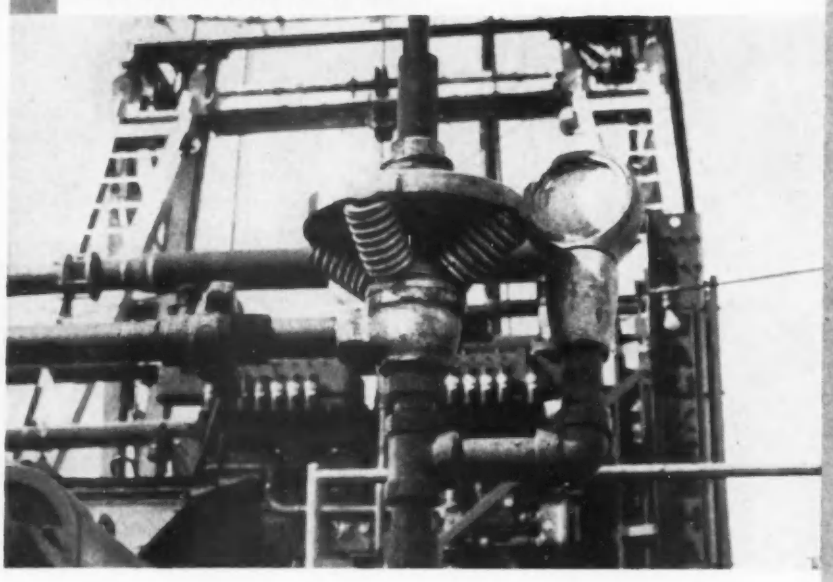

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for the Colorado Production district at Fort Morgan; **Johnny Murphy, Jr.**, who has joined the company as petroleum engineer in the Fort Morgan district office; and **Robert S. Haigh**, new geologist in the Billings, Mont. district office. New junior geologists in the Casper district office are **John H. Dayvault** and **Lester Livingston, Jr.**

•

T. E. Hull and **C. L. Walker** have been appointed district geologists in **Stanolind Oil and Gas Company's** Casper and Billings district exploration office. **Hull**, who joined Stanolind in 1948, will fill the position at Billings. He has been area geologist since March, 1953. **Walker**, hired by Stanolind in 1947, became staff geologist for the Casper district in 1952.

•

Russell T. Shirley has been promoted from marine drilling tool foreman to assistant marine drilling supervisor in **Magnolia Petroleum Company's** Louisiana-Gulf division with headquarters at Morgan City, La.

•

Sidney E. Daviston, petroleum engineer for **Magnolia Petroleum Company**, has been moved from Lake Charles, La., to Alice, Texas. **Robert J. Swaim**, petroleum engineer, has been transferred to Lake Charles from Alice.

•

Thos. L. Wark, vice president, has been appointed divisional general manager of Tide Water Associated Oil Company's Western division, and **Charles R. Brown**, vice president, has been appointed assistant division general manager of that division. In their new assignments, Wark and Brown, with headquarters in San Francisco, will be in charge of all operations of the states of California, Oregon, Washington, Arizona, Utah, Idaho and Nevada, the Territory of Hawaii and the Philippines. Wark has been with Tide Water for 34 years starting as resident geologist at Ventura, Calif., and since 1937 has been in charge of the Production department, Western division. He was appointed vice president of the Company in 1946. Brown, who has been in Tide Water Associated's service since 1917, has served in various capacities in the company's Administrative department, including administration of the company's overall industrial relations and public relations activities. He has been a vice president since 1948.

•

C. E. Beecher, Cities Service Oil Company, Bartlesville has been elected president of **Drilling Research, Inc.**, to succeed **C. P. Dimit**, who resigned due to ill health. Dimit had held the position of president since the organization was formed in 1948. Beecher has been associated with the development and producing phases of the oil business for many years. Drilling Research, Inc., was formed to develop new methods and apparatus for drilling oil and gas wells and currently are preparing to field test a new drilling apparatus.

•

Joseph A. Thomas has been elected a member of the board of directors of Tide Water Associated Oil Company. Thomas, a graduate of Yale University and Harvard Business School, and a resident of Old Brookville, N. Y., is a partner of Lehman Bros., Investment Bankers, New York. He is a director of many corporations including American Export Lines, Flintkote Co. and National Airlines, Inc. Thomas replaces **John Hertz**, a member of Tide Water's directorate since 1937. Hertz, a senior partner of Lehman Bros., terminated his Tide Water directorship in order to devote his entire time to his many other interests.

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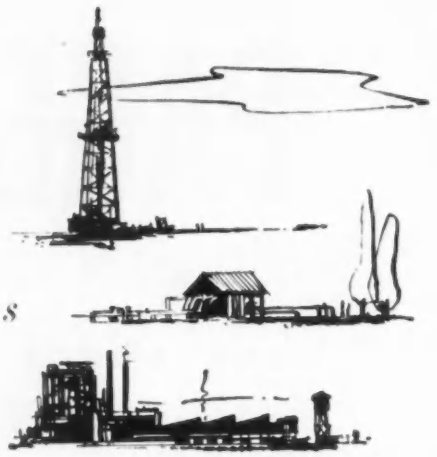

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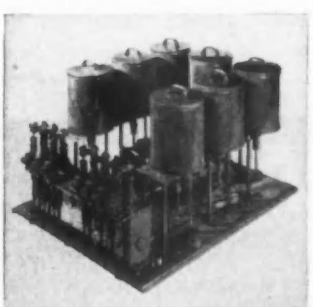

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L. Claude Roark and **Park G. Ogden, Jr.**, have been appointed to the geological staff of **Buffalo Oil Company.** They will work under the supervision of **John L. Ferguson,** recently named manager of exploration. Roark will become geologist in charge of the Tulsa exploration offices and Ogden will hold the same post at Lafayette, La. Both offices are being established for the first time.

Roark, who had served as district geologist for Sinclair Oil and Gas Company the past four years, was graduated in 1940 from the University of Oklahoma with a B.S. in geology and did graduate work at Stanford. He started his geological career with the British-American Oil Company in Tulsa in June 1940 and continued with the firm until February 1941. Roark accepted a post with the Phillips Petroleum Company in the Rockies and adjacent areas until November 1950 when he joined Sinclair.

Ogden had been employed since 1948 as an exploration geologist in southern Louisiana for Stanolind Oil & Gas Company. After military service during World War II, he took a B.S. in geology from Ohio State in 1947 and did graduate work there.

•

Dr. Leonard B. Lipson, senior research physicist at Magnolia's Field Research Laboratories, Dallas, has been appointed an associate professor of petroleum engineering at the University of Houston. Dr. Lipson will assist in the development of the graduate program in petroleum engineering and will conduct research in the field of core analysis and well logging.

•

Robert H. Love has been transferred from Great Bend, Kansas, to **Lion Oil Company's** Oklahoma City production and exploration office. Love assumes the position of district landman in the Oklahoma district, having served over a year as landman at Great Bend.

•

Phillips Petroleum Company's Production department operations are being carried out under three area managers located in the company's headquarters in Bartlesville, replacing the present regional organizations supervised from four field offices. **C. A. Daniels, Earl Griffin** and **Frank Lovering** have been appointed to the new area manager positions, reporting to **J. M. Houchin,** general superintendent of the Production department. **L. E. Fitzjarrald** is manager of the department. Daniels will be manager of the central area. This includes properties formerly in the northern region and consists of divisions headed by the following superintendents: **F. W. Shelton,** Wichita, Kansas; **M. L. Atkinson,** Ponca City, Okla.; **G. J. Turner,** Oklahoma City; and **J. N. Perkins,** Amarillo, Texas. **Earl Griffin** will manage the southern area consisting of properties previously in the southern region. This area includes divisions under **C. M. Oden,** Shreveport, La., and **V. P. Ethridge,** Houston. **Frank Lovering** was appointed manager of the new western area including properties formerly in the northwest and western regions. The northwest division consists of the former northwest region and will be under **Claude E. Peavy** as superintendent. The present western region will be divided in two divisions. **D. A. Miller** is superintendent of the Western division and **M. R. Hayes** becomes superintendent of the Texmex division.

Arnold S. Bunte has joined the staff of the Denver National Bank, in the capacity of consulting geological engineer. He will assist the bank in expanded financing services to the oil industry. A graduate of the Colorado School of Mines in 1926, Bunte completed special graduate work at the University of Oklahoma in 1931, and from 1926 until 1938 was employed by the Shell Oil Company as exploration geologist. He served as consulting geologist and engineer in Kansas, Oklahoma, Texas, Louisiana and Arkansas until 1941, at which time he joined the Vickers Petroleum Company, becoming successively chief geologist, chief engineer, exploration manager, division manager of the Permian Basin, and consulting and research geologist. In 1953 Bunte joined the faculty of the Colorado School of Mines as associate professor of geology, a position which he will continue to hold.

•

Fred B. Branson, assistant comptroller, has been appointed manager Tax department for the Gulf Oil Corporation and its subsidiaries succeeding **Samuel Johnson**, who is retiring after 33 years of service. **William T. Grummer**, manager, accounting, has been elected an assistant comptroller of the corporation and subsidiaries, and will supervise production, pipe line, and research accounting and related activities, succeeding Branson. **Robert H. Leitch, Jr.**, assistant manager, accounting, has been appointed manager, accounting, succeeding Grummer. The activities of all three men will be under the direct supervision of **W. L. Naylor**, vice president and comptroller.

•

P. H. Garrison has been promoted to division geophysical supervisor for the Central division of **Stanolind Oil and Gas Company.** Garrison comes to Oklahoma City from Stanolind's Lubbock, Texas, district where he was field seismograph supervisor in charge of the geophysical office.

•

E. E. Fickinger, Midland, Texas, member of **Continental Oil Company**'s Exploration department, has been promoted to geophysical supervisor. He will make his headquarters at Midland. Fickinger joined Conoco in 1947 and served with company exploration crews in many midwestern and southwestern states before transferring to Midland in 1953.

•

Albert J. Kelly has been appointed general manager of the Purchasing department of **Esso Standard Oil Company** to succeed **Joseph M. Sitler**, a director and head of purchasing who is retiring after 33 years service with the company. **Bertram A. Warren** and **John W. Rush** were named assistant general manager and assistant to the general manager of purchasing. Kelly has been associated with the company's purchasing activities since joining the company as a buyer in 1919 and has been general purchasing agent since 1948. Warren entered the Purchasing department after joining the company 31 years ago and has served as assistant general purchasing agent since 1953. Rush, who joined Esso at the Bayonne refinery, transferred to the Purchasing department in 1923 and has been assistant to the general purchasing agent since 1950.

Sitler joined Standard Oil Company (New Jersey) as office manager in the Purchasing department in 1921. He became assistant purchasing agent for the

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operating company now known as Esso Standard and in 1928 was made general purchasing agent for Humble Oil & Refining Company in Texas. He rejoined Esso in 1935 as assistant purchasing agent and was elected to the board of directors in 1941. He became director of purchasing in 1942.

•

John N. Gilbert II has resigned from **Standard Oil Company of Texas** to engage in the oil business as an independent operator. He will continue to make his home in Houston.

•

The Texas Company has announced the election of **M. Halpern**, vice president—refining, to a new executive post, senior vice president. Halpern joined The Texas Company in 1916 as an assistant civil engineer. He held various supervisory positions at the company's terminals and refineries, becoming general manager of the Refining department in 1938. He was elected a vice president in 1940 and named a director of the company in 1946.

•

Humble Oil & Refining Company has announced the following changes in its Production department supervisory personnel:

W. B. Burgess, gas plant superintendent, Kilgore gas plant, transferred to the Heyser gas plant as gas plant superintendent, replacing W. J. McDougal, deceased; **Carl Lee Locke**, toolpusher, Imogene district, Southwest Texas division, transferred to the Conroe district, Gulf Coast division, as toolpusher; and **Hugh G. McKinley**, roustabout gangpusher, promoted to farm boss at the London District, East Texas division.

•

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Joseph T. Dawson and **Joseph L. Cramer** have formed a partnership and will operate as the firm of **Dawson and Cramer** with offices at 516 Symes Building, Denver. The firm will concentrate on drilling operations in the Denver Basin.

•

Forest Oil Corporation has announced the election of **Dale H. Dorn** as president of the company, and a member of the board of directors. **Forest D. Dorn**, president of the firm since its beginning, has been named to the newly-created post of chairman of the board. **Martin F. Casey** has been elected executive vice president.

•

A. J. Crowley has joined **Continental Oil Company** as Rocky Mountain region research geologist, with headquarters at Denver. **T. R. Carpen**, Denver, geologist, has been promoted to division geologist for Conoco in Denver, succeeding **J. H. Goth, Jr.**, who recently resigned.

Crowley received his master's degree in geology from the University of Minnesota and was an instructor for one year at the University of Wichita. He also has served as a geologist with the U. S. Geological Survey and other oil companies in Kansas and the Rocky Mountain region. With Conoco, he will devote his attention primarily to the geology of radioactive mineral deposits. Carpen received his bachelor's degree in geology from Northwestern University and joined Conoco at San Antonio, Texas, in 1949. He transferred to Denver in 1952.

•

Robert H. Mansfield has joined the **Southern California Petroleum Corporation** organization as exploration geophysicist. Mansfield was recently associated with United Geophysical Company as senior geophysicist. When with United, he had for several months worked on reinterpretation of seismic data owned by the International Egyptian Oil Company on leases in the Sinai Peninsula area of the Gulf of Suez, Egypt. Mansfield recently returned from Cairo, Egypt, having worked in the company headquarters there, coordinating seismic information with **Frank E. Lewis**, chief geologist in that region.

•

Sohio Petroleum Company has announced the transfer of **Vernon E. Holmes** to the Northwest division replacing the late **Walter L. McCloy, Jr.**, as superintendent, production operations. Holmes has been with Sohio since 1943, serving as petroleum geologist, district superintendent, manager of industrial relations, assistant division superintendent and lately as division superintendent of the Gulf Coast division.

In another Sohio transfer **Raymond E. Thomas** moves to the Billings office as division supervisor of rentals and records.

•

Southwest Gas Producing Company, Monroe, La., has announced the election of **Max L. Riley**, formerly chief engineer, as director, vice president and general manager to succeed **Z. C. Ambrose**, who resigned to become connected with a firm in Houston. **P. B. Snodgrass**, treasurer of Southwest Gas, has been elected a director. **John H. Crump**, director, vice president and geologist, will continue in charge of the Land and Exploration department of the company and **Richard F. Cox**, formerly district engineer at the Dubach office, has been appointed chief engineer of the company and will be located at the Monroe office.

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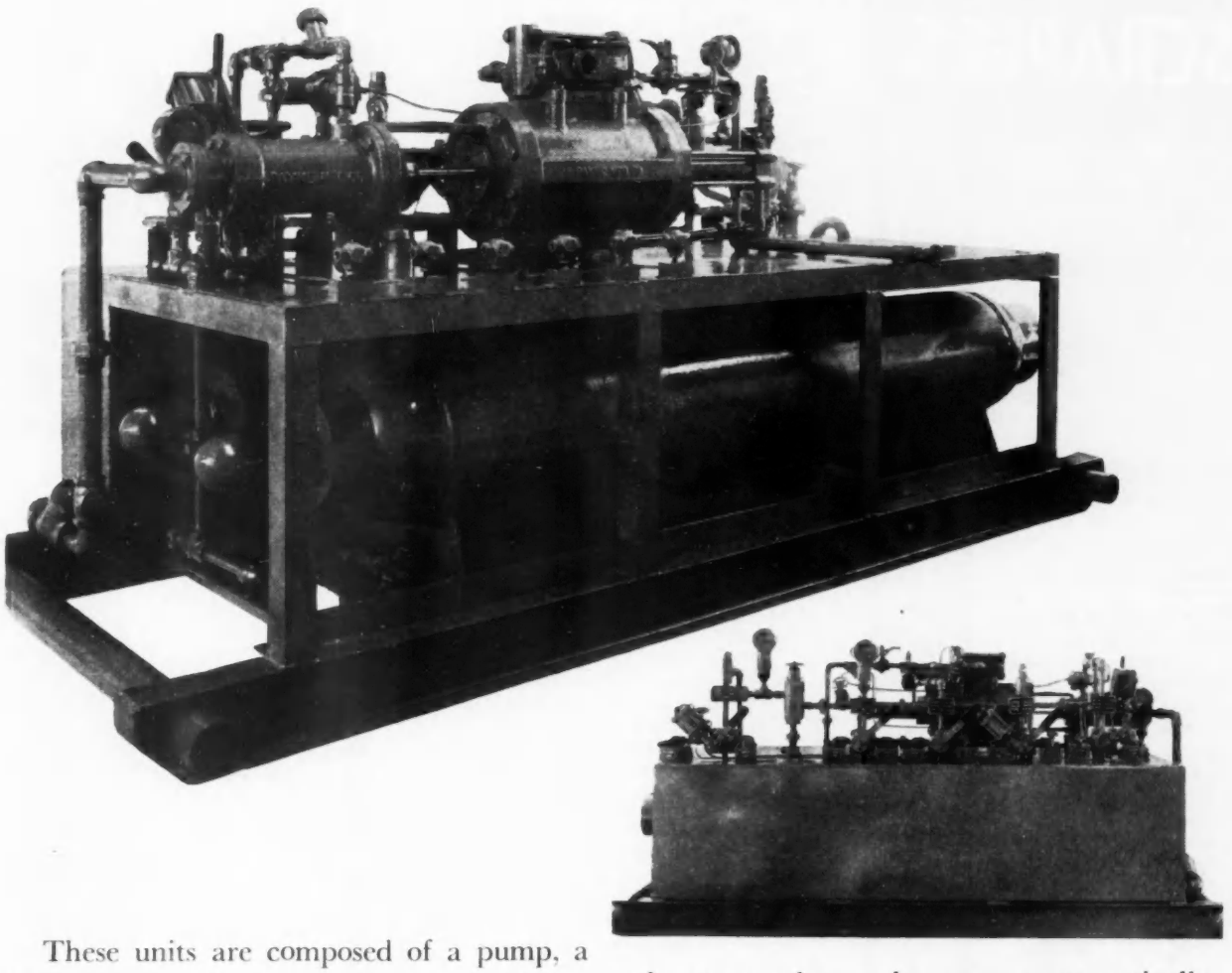

These units are composed of a pump, a hydro-pneumatic accumulator, a fluid reservoir and fluid control manifold for any number of blowout preventers.

Air, steam, electrical, and gasoline powered Payne pumps with several volumes and pressures are furnished with these units.

The fluid pressure accumulator is manufactured in two sizes—40 and 80 gallons—both with 2000 PSI working pressure.

When the pressure drops to 1800 PSI on the accumulator, the pump automatically returns the pressure to 2000 PSI by means of a pressure switch which cuts the power to the pump at that pressure.

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Michel T. Halbouty, independent geologist and petroleum engineer, has completed a 12-month expansion and reorganization of his firm. Exploration and production personnel have been departmentalized and two new exploration divisions and a new production district have been formed within the organization. Land, Geological and Production departments will be under the supervision of George C. Hardin, Jr., who was named exploration and production manager. Hardin is a geologist and petroleum engineer and has been associated with Halbouty for more than eight years. Head of the Land department is **Robert L. Reese**, formerly with Sohio Oil Company and new chief accountant is **Tom Leger**, formerly with Kirby Petroleum Corporation. **W. H. Lacy**, petroleum engineer, who has been with the Halbouty firm for three years, was named general drilling and production superintendent. Boling production district superintendent is **James L. Ward**, formerly with J. S. Abercrombie. **Charles R. Musick**, engineer-draftsman, one of Halbouty's long-time employes, is now head of the enlarged Mapping department, and is chief draftsman.

In the Exploration department, a Gulf Coast Frio division was formed and **John E. Walters**, formerly geologist with the Humble Oil and Refining Company, was appointed division geologist. A Gulf Coast Yegua-Wilcox division was formed and is headed by **Fred W. Howells** as division geologist. Howells was formerly geologist for the American Republic Corporation. **James L. Noel**, general counsel for the concern, formerly with the law firm of Butler, Binion, Rice and Cook, has opened private law offices at 319 Shell Building, to be more accessible for consultation with the Halbouty firm's personnel.

Formation of the new exploration divisions and the appointment of the new department heads were the results of Halbouty's greatly expanded exploration, drilling and production activities, which have to date resulted in the discovery of considerable new oil and gas reserves. The reorganization will facilitate the supervision of drilling wells and the research and analysis of subsurface geological and geophysical data necessary for the acquisition of new prospects.

•

American Republics Corporation has announced the following changes in the personnel: **N. B. Baird**, assistant manager of the western division operations, has been made manager of unitization and joint operations; **R. F. Sawyer**, assistant manager of eastern division operations, is named manager; **W. T. Bryant**, assistant manager of gasoline and cycling plants, is now manager; **John S. Floeter**, formerly chief petroleum engineer, is manager of the western division operations; and **Ralph I. Ellsworth**, is promoted from division petroleum engineer to chief petroleum engineer.

•

John R. Brack has been employed by **Forest Oil Corporation** as a petroleum reservoir engineer in the Midland, Texas office. Brack has been employed by The Ohio Oil Company in Iraan and Midland, Texas, as a petroleum engineer since his graduation from the University of Texas.

•

Hiawatha Oil Company has promoted **Charles Severy** from division geologist to manager in the Denver office and in charge of the Rocky Mountain operations.

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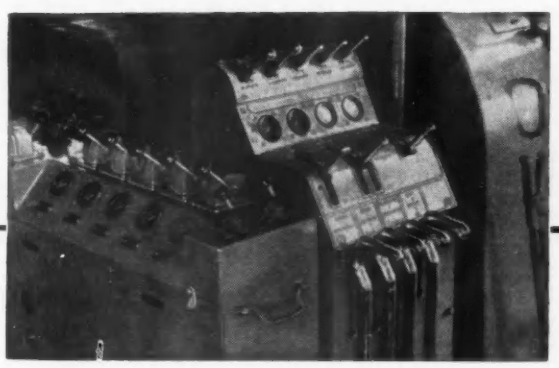

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DEATHS

Noble A. Endicott, a vice president in charge of Gulf Coast operations for Continental Supply Company, died September 4 at his home in Houston. Endicott served in various capacities for Continental during his 38 years with the company. His most recent previous position was as manager of Continental's Canadian operations. At the time of his death, he was president of the company's 25-Year Club. He was also a member of the Petroleum clubs of Houston and Dallas and president of the Houston Nomads chapter. Endicott was born in St. Louis, Mo., in 1895.

Noble Endicott

•

Myer L. Roberts, 45, of Nowata, Okla., owner of Keystone Drilling Company, died August 22 from injuries sustained in an airplane crash near Mason City, Iowa.

•

Virgil O. Wood, 62, well known geologist and bank official, died in Oklahoma City August 26. Wood was a partner in the Broswood Oil Company.

•

Max W. Ball, senior member of the firm of Ball Associates, Washington, D. C., died August 28. Ball was internationally known as an expert on petroleum matters. During World War II he served as special assistant to the Deputy Administrator of the Petroleum Administration for War. Later he was again called to the government as first director of the Oil and Gas division of the Department of Interior to undertake the organization of that division as a successor to the Petroleum Administration. After that Ball undertook private consulting work as organizer and senior member of the firm that became Ball Associates. He was widely known for his writings on oil and gas matters.

Max W. Ball

•

Jo O'Neill Gibson, 44, of Tulsa, executive of Nelson Electric Manufacturing Company and formerly with Phillips Petroleum Company, died July 27.

•

Clifton W. Johnson, geologist for Richfield Oil Corporation for the past 17 years, was killed in July in an automobile accident in the San Bernardino Mountains about 60 miles east of Los Angeles.

•

Charles S. Davis, 77, chairman of the board and formerly president of Borg-Warner Corporation, died July 2 while on a European tour.

•

Sylvan Hunt (Andy) Anderson, 56, Tulsa oil operator, geologist and attorney, died July 11 in Muskogee, Okla.

Homer R. Butcher, 54, senior engineer in the Denver area for Shell Oil Company, died June 29. A native of Kansas, Butcher spent most of his professional career in Kansas. He was a member of the American Congress on Surveying and Mapping, Colorado Society of Engineers, Denver Petroleum Engineers and National Association of Professional Engineers.

•

C. W. (Bill) Eckman, sales manager of Northwestern Refining Company, died June 28 in St. Paul Park, Minn. Formerly Eckman was with Standard Oil Company of Indiana; Manhattan Oil Company, which later became White Eagle Oil and Refining Company; Marland Refining Company; and H. K. Stahl Company.

•

James D. Long, 83, independent oil operator, died in Dallas July 26. Long was an independent operator in Ohio, Indiana and Illinois, later moving to Texas where he served as superintendent for Republic Production Company and The Texas Company. Later he moved to El Dorado, Ark., where he operated independently, and to Los Angeles. Long is the father of R. L. and D. D. Long, both of Hughes Tool Company.

•

Walter L. McCloy, Jr., division superintendent of operations, Northwest Division, Sohio Petroleum Company, died July 4. McCloy had been with Sohio since 1939 serving in many supervisory positions.

•

Lloyd Williamson, 64, president of Mascot Oil Company and Lakeport Petroleum Company, Los Angeles, died July 3 in Los Angeles. A well-known independent producer, Williamson was past president of the Oil Producers Agency of California and a director of the Independent Petroleum Association of America.

•

C. L. (Buck) Kienzle, 64, of Tulsa, chief clerk and office manager of the Materials and Purchasing department, Mid-Continent Petroleum Corporation, died July 22.

•

Ernest L. Eppenauer, 61, of Tulsa, secretary-treasurer of United Supply and Manufacturing Company, died August 15.

•

W. W. Bruce, 72, Ponca City, Okla., retired executive vice president of Continental Oil Company, died August 21.

•

Hiram J. Wagner, a depreciation engineer with the United Fuel Gas Company since 1951, died recently in Charleston, W. Va.

•

Fred T. Haddock, Sr., 66, Oklahoma independent operator, died August 23.

•

Joseph W. Loftin, 69, retired district superintendent of the Sinclair Oil and Gas Company, died August 30 in Tulsa.

•

Leonard G. Stanley, 63, died August 25 near Springdale, Ark. Stanley was a retired pipe line contractor.

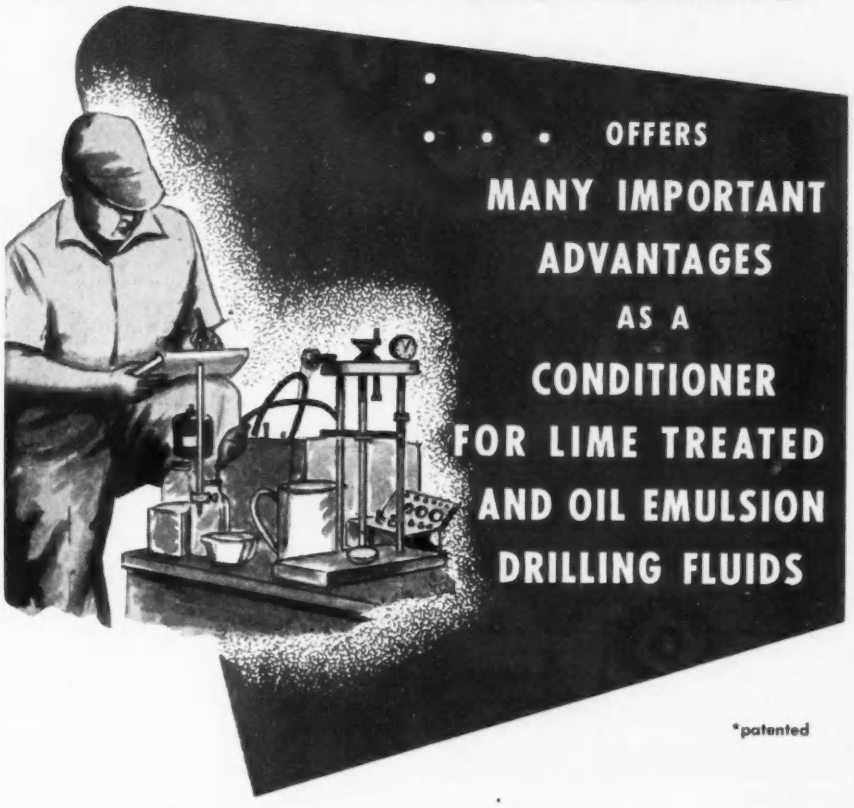
•

Robert G. Martin, 68, retired Deep Rock Oil Company official, died June 12 in Tulsa. Martin was purchasing agent for the firm 25 years before retiring in 1949.

•

Frederick James Thompson, 64, engineer for the National Tank Company, died June 16 in Tulsa.

MARATHON'S CALCIUM LIGNOSULFONATE*



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What's Happening

AMONG INDUSTRY ASSOCIATIONS

Geologists Plan Annual Meeting

Committee chairmen who are planning activities for the meeting of the Gulf Coast Association of Geological Societies in Houston November 3-5 are left to right, front row, Hillard W. Carey, entertainment; E. W. Kimball, finance; R. R. Rieke, general chairman; W. R. Canada, program chairman; and Dr. Shirley L. Mason, publications; back row: R. W. Wilson, housing; Lloyd D. Traupe, program co-chairman; William P. Craddock, registration and tickets; W. Kenley Clark, advertising; and J. S. Spencer, publicity.

Special Trains Planned For API Conventioneers

Special trains will be operated by the Santa Fe Railroad from Tulsa and Houston to Chicago and back for the American Petroleum Institute's meeting November 8-11.

The train from Houston will leave at 3 p.m. November 6 and arrive in Chicago at 4 p.m. November 7. It will leave Chicago for the return trip at 3 p.m. November 11, arriving in Houston at 4 p.m. November 12.

API men from the Fort Worth and Oklahoma City areas are expected to take advantage of the Houston train's stops in those cities. In addition, the regular Texas Chief between Fort Worth and Chicago will have extra cars on November 6 and 11.

From Tulsa, a special train will leave at 5 p.m. November 7 and arrive at 8 a.m. November 8. On its return trip, it will depart at 4:30 p.m. November 11, arriving at 7:30 a.m. November 12. Santa Fe officials may schedule the train for a stop in Bartlesville to take on passengers.

The special trains will have Pullmans, lounge and dining cars, and baggage cars.

Houston Desk and Derrick Elects New Officers

Mrs. Leah Vinson, Gulf Oil Corporation, has been named president of the Houston Desk and Derrick Club for 1954-1955. Mrs. Vinson served as vice president—programs last year and was unopposed for the presidency.

Other officers elected were Miss Ida Brigham, Humble Oil & Refining Company, first vice president—publicity; Miss Peggie Walters, Mid-Century Oil and Gas Company, second vice president—programs; Mrs. Sue Boehmer, Brazos Oil & Gas Company, recording secretary; Mrs. Edwina Reddick, Columbian Carbon Company, corresponding secretary; and Mrs. Iris F. Harmon, Shell Oil Refinery, treasurer.

Miss Aline Jerabeck, Federal Royalty Company; Miss LaVerne E. Collins, Tennessee Gas Transmission Company; Mrs. Virginia Vincent, Halliburton Oil Well Cementing Company, and Miss Ellen Petitfils, Humble Oil & Refining Company, were elected directors. Miss Lois Johnston, Gulf Oil Corporation; Miss Agnes McClelland, Pan American Production Company; Miss Louise Phillips, The Texas Company; and Miss Pat Rourke, Drilling Specialties Company, are serving their second year on the board.

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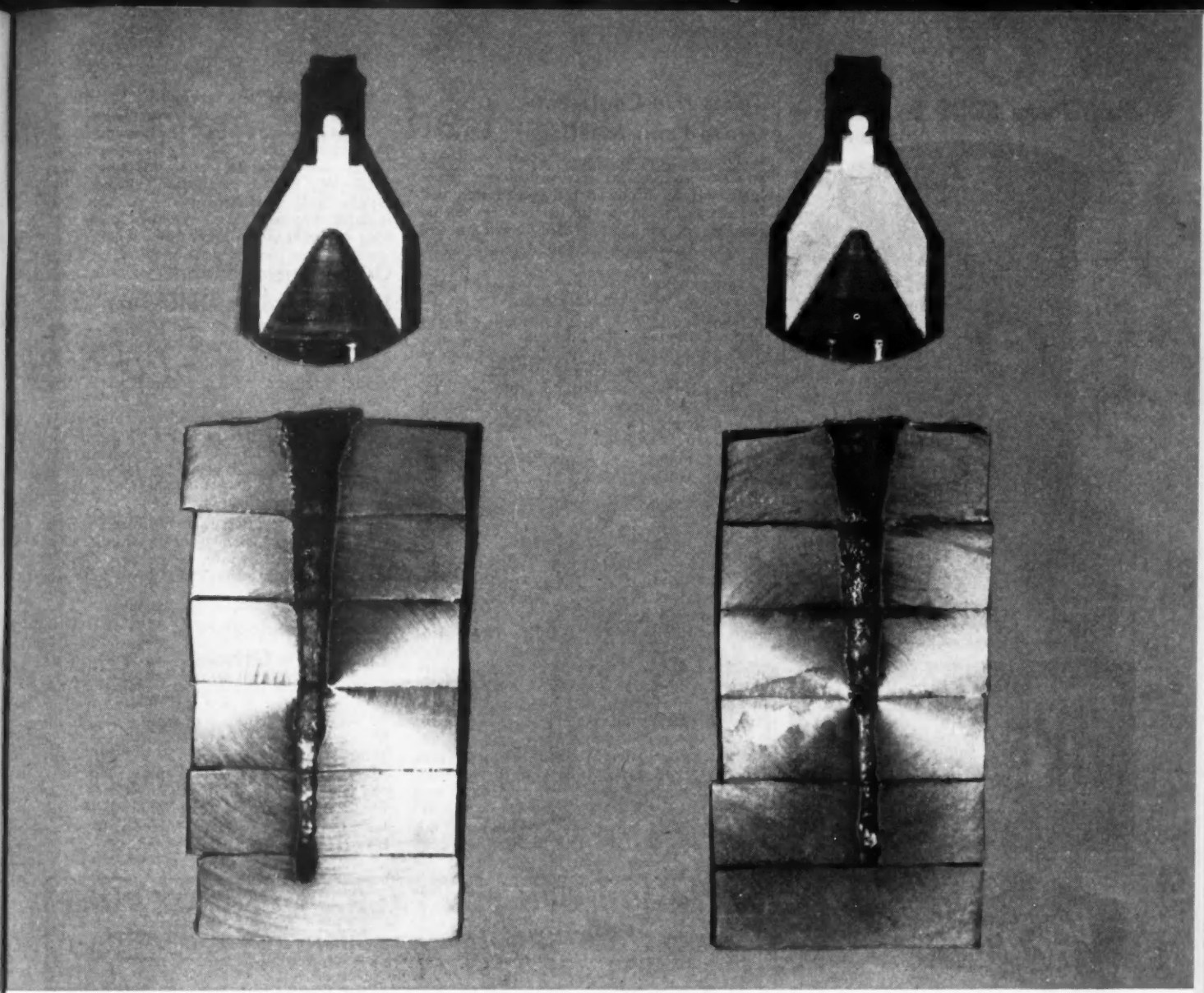

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Texas Mid-Continent Group Plans Meeting

Topics ranging from global military strategy to natural gas producers' problems will be discussed by government and industry officials at the thirty-fifth annual meeting of the Texas Mid-Continent Oil & Gas Association in San Antonio October 5 and 6.

Independent operators and company executives will hear addresses by E. C. Manning, premier of the province of Alberta, Canada's chief oil-producing region, and Adm. Arthur W. Radford, chairman of the U. S. Joint Chiefs of Staff.

Oil officials on the program will include P. C. Spencer, president of Sinclair Oil Corporation and chairman of the American Petroleum Institute; George T. Naff, president of Texas Eastern Transmission Corporation; J. C. Donnell, II, president of Ohio Oil Company; and Harry W. Bass, independent producer and drilling contractor who is president of the association.

Frank B. Lefevre, San Antonio independent producer, is chairman of general arrangements for the convention. Headquarters will be the Plaza Hotel.

Scheduled for the opening day's program are addresses by Bass, Naff, and Admiral Radford. In the afternoon there will be committee meetings, and at night, dinners and receptions honoring association directors and members of the press.

On the second day there will be addresses by Premier Manning, Donnell, and Spencer, and presentation of the association's Distinguished Service Awards to two petroleum industry leaders. There will be a golf tournament in the afternoon at Oak Hills Country Club. The annual membership dinner will be that night in La Villita.

Chairmen of convention committees are, besides Lefevre, Harold D. Herndon, entertainment; B. A. August, transportation; Hugh A. L. Halff, press arrangements; Fred W. Shield, reception; Randle R. Hanks, golf tournament; L. A. Douglas, registration; and Mrs. Arthur A. Seeligson, ladies' entertainment.

Oil Exposition Planned In Pauls Valley, Oklahoma

A "Golden Trend" Oil Exposition will be held at Pauls Valley, Okla., October 22-24, and will be sponsored by the Golden Trend Chapter, API and the Pauls Valley Chamber of Commerce. The "Golden Trend" is a tier of southern Oklahoma counties which produce the bulk of the state's oil production. The exposition will be held at the County Fair Buildings at Pauls Valley and will include a parade and entertainment.

Anyone interested in exhibiting oil field equipment at the Exposition should contact James T. Jackson, secretary, Golden Trend Oil Exposition, P. O. Box 238, Pauls Valley, Okla.

Illinois Geologists Elect New Officers

Members of the Illinois Geological Society have been chosen for 1954-55. Edwin E. Rue, independent operator of Mount Vernon, is the new president, succeeding James C. Lewark, The Carter Oil Company, Mattoon. Carl F. Pampe, The Pure Oil Company, Olney, is the new vice president and Asa D. McRae, Magnolia Petroleum Company, Mount Vernon, is secretary-treasurer.

Bugs and Business DON'T MIX!

Ever try to stab a joint or run a spinning line while a stink bug crawled up the back of your neck?

A BEMCO Bug Blower would have prevented your predicament. The baby hurricane created by its 66" airplane type blade would have taken that varmint away from there, and what's more *kept the entire floor bug-free.*

Think back to *your* stink bug . . . and then remember to order a BEMCO Bug Blower *today.* One on each of your rigs will keep the bugs out of your business.

L&H
L&H MACHINE WORKS
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EXPORT: Baird Supply Co., Inc.
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OVER 100 GPH FOR EACH POUND OF PUMP
YET THIS *FLOMAX-15* IS MADE OF TOUGH IRON FOR LONG LIFE
EASY TO HANDLE——WEIGHS LESS——COSTS LESS

FLOMAX **Super Hard Seals provide longer trouble-free pump life without nuisance of filling grease cups or fear of dirty grease.**

FLOMAX **Open Adaptor construction protects your engine from stray pumpage. Also provides plenty of room to work and see when servicing pump.**

FLOMAX pumps are	***FLOMAX*** pumps have
Self-Cleaning	Replaceable Wear Plate
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Companies in the News

STANOLIND OIL AND GAS COMPANY has been cited by two organizations for its accomplishments in the field of industrial safety during 1953. The Joseph A. Holmes Safety Association, sponsored by the U. S. Bureau of Mines, has awarded Stanolind 27 certificates of honor for safety achievements in various phases of its operations. Three of these awards went to the company's research laboratory in Tulsa. The process research division of the laboratory was cited for having no lost-time accidents from October 30, 1950 to December 31, 1953 and continuing, for a total of 751,050 man-hours worked by 99 employes. The production research division completed 957,699 man-hours of work by 112 employes without a lost-time accident, during the period from September 2, 1949 to December 31, 1953 and continuing. The Research department as a whole received an award for having no accidents from June 27, 1952 to August 17, 1953, involving a total of 1,007,600 man-hours for 420 employes. The balance of the Holmes awards were distributed among the company's four domestic divisions, with headquarters in Oklahoma City, Fort Worth, Houston and Casper.

Stanolind also received two American Petroleum Institute accident prevention awards. One award was presented to the production research division of the Research department; the other API award went to Stanolind's North Texas-New Mexico division.

•

Plans for the merger of **THE DERBY OIL COMPANY**, Wichita, Kansas, into the **COLORADO OIL AND GAS CORPORATION**, Denver, have been announced. The Derby Oil Company and its predecessor companies have been operating since 1917 in the production, transportation, refining and marketing of crude petroleum and its products. The company's principal oil producing properties are located in Kansas, Oklahoma, Texas and Nebraska. Colorado Oil and Gas Corporation, 64 percent owned by Colorado Interstate Gas Company, Colorado Springs, has substantial gas reserves in the Greenwood Field, Morton County, Kansas, the Keyes Field, Cimarron County, Oklahoma and in the San Juan Basin, New Mexico. Most of the acreage in these fields is proven for gas production and the company is engaged in its development. Colorado Oil and Gas properties include more than 500,000 net acres of leases in the Rocky Mountain Region, Nebraska, Kansas and Oklahoma, and oil and gas production on the Texas Gulf Coast.

•

SOCONY-VACUUM OIL COMPANY, INC. has announced the incorporation of **MOBIL PRODUCING COMPANY**, a wholly owned subsidiary of Socony-Vacuum. The new company will take over the operations formerly handled by the Pegasus Division of Socony-Vacuum. Mobil Producing will conduct exploration and producing operations in the U. S. portion of the Williston Basin and in the northern Rocky Mountain area. **W. W. Clawson**, formerly manager of the Pegasus division, has been elected president of Mobil Producing Company. Clawson will also remain president of Socony-Vacuum Oil Co. of Canada, Ltd. **A. F. Barrett** was elected vice president and manager of production of the new company and **John T. Rouse**, vice president and manager of exploration. Both men have been associated with the Pegasus division in Billings, Mont. since its establishment. Headquarters for Mobil Producing Company will remain in Billings, where the company is now constructing a new office building.

•

WARREN-BRADSHAW EXPLORATION COMPANY has announced the opening of a new division office in the Colorado Building in Denver to handle land and geological operations in the Rocky Mountain area. **Joseph H. Goth, Jr.**, formerly associated with Continental Oil Company, will head the new office.

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. . . forged from ONE PIECE of Alloy Steel

NO WELDS TO BREAK . . .

Each SPANG WELDLESS JAR is forged from a single piece of selected alloy steel and is scientifically heat-treated and tempered to obtain proper hardness and toughness in the rein sections for maximum strength and wear resistance in the most severe drilling service.

The joints, heat-treated and precision machined, are stronger and more durable, assuring fewer fishing jobs. Records over the years show up to four times more footage with SPANG Alloy-Steel WELDLESS JARS.

For further information on weldless jars, and for FREE CATALOG of other SPANG cable tools, contact your nearest Dealer or write direct to:

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For over 60 years Manufacturers of Spang Weldless Jars and a Complete Line of Cable System Drilling and Fishing Tools for Oil and Gas Wells, Water Wells, Prospect Drilling and Shot Blast Holes.

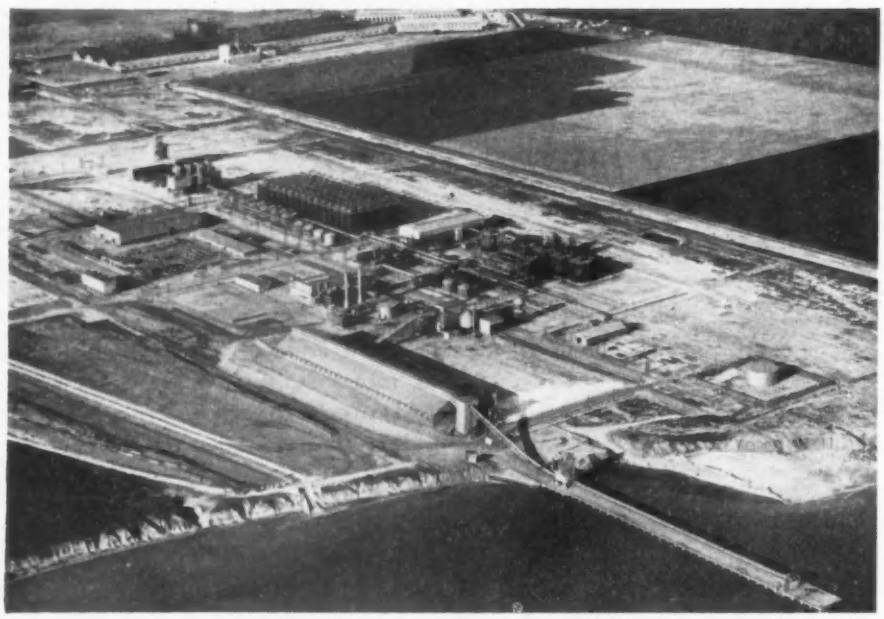
(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

What's Happening

AMONG SERVICE AND SUPPLY MEN

Plant To Be Erected in Canada

Frank Bergeron, left, vice president of Jet Lube Inc. of California, is shown with Hoyte E. Snelson, managing director of the new Jet-Lube of Canada, Ltd. Recently Bergeron visited Edmonton, Alberta, to complete negotiations for the establishment of a plant for manufacturing under license of Jet-Lube lubricants in Canada. Officers and directors of the new Canadian corporation are W. L. Falkner, president; Snelson, vice president and managing director; J. F. Langston, secretary-treasurer; and W. F. Knode, director. All Jet-Lube lubricants for the oil field, aviation, automotive, mining, marine and other industrial uses will be produced in Canada for Canadian consumption.



Reynolds Metals Operates Two Industrial Plants

Across the bay from Corpus Christi, Texas, Reynolds Metals Company has built and put into operation two industrial plants for the production of aluminum. In the photograph are shown La Quinta alumina plant in the foreground and San Patricio reduction plant in the background. The La Quinta-San Patricio industrial complex is the only aluminum-processing center in the U. S. where bauxite-ore is delivered by ocean-going ships and then converted to pig-aluminum without overland shipment. In the production of pig aluminum Reynolds mines the bauxite ore in Jamaica, British West Indies; then converts the bauxite to aluminum-oxide and reduces the alumina to metallic aluminum at the Corpus Christi plants.

John A. Roebling's Sons Appoints Cole Pacific Coast Manager

Robert J. Cole, prominently identified with construction of many of the country's suspension bridges built during the past 25 years, including the Golden Gate and the new Tacoma Narrows span, has been named by the John A. Roebling's Sons Corporation as Pacific Coast manager of the firm's Construction Materials division. John A. Roebling's Sons is a wholly-owned subsidiary of the Colorado Fuel and Iron Corporation.

Cole, more recently serving as president of the Pointer-Willamette Company at Edmonds, Wash., will now direct the sale of Roebling wire and stranded steel products for prestressed concrete use. His offices are located in the corporation's San Francisco district headquarters at 1740—17th Street.

Oil Well Supply Announces Personnel Appointments

Hobert R. Redick has been appointed city representative at Wichita, Kansas, for U. S. Steel's Oil Well Supply Division. Redick was employed by Oilwell at Russell, Kansas, in 1947 and has served as field representative for the division at El Dorado, Kansas; Wewoka, Okla.; and Arkansas City, Kansas.

Oilwell has also appointed E. Wayne Alexander area merchandise manager, Oklahoma City. Alexander was employed in 1937 at Oilwell's Oklahoma City store and was transferred in 1944 to the division's store at Cushing, Okla. Since then he has served the company in Russell. Tulsa and Oklahoma City.

Globe Oil Tools Appoints Wardle General Sales Manager

Globe Oil Tools Company has announced the appointment of Lee Wardle to general sales manager. Wardle started with Globe in 1938 when he became a member of the sales organization working in the Los Angeles Basin. For the past four years he has been California sales manager, establishing branches in Ventura and Bakersfield.

Rockwell Manufacturing Promotes Thomas Carson

Thomas O. Carson, manager of Rockwell Manufacturing Company's International division at New York City for the past five years, has been promoted to assistant product manager, Nordstrom Valves. He will make his headquarters at the company's home office in Pittsburgh.

A native of New York, Carson joined Rockwell as a sales engineer in the International Division in 1945 and traveled extensively through Mexico, Puerto Rico, Cuba, Venezuela, Colombia and Canada.

Before joining the company, he was employed as a water meter salesman by Phoenix Meter Corporation from 1935 to 1941.

James M. McFadden

John R. Brennan

Personnel Appointments Made By Fluid Packed Pump Company

James M. McFadden has joined Fluid Packed Pump Company as controller. A graduate of the University of California, McFadden has a thorough knowledge of the oil tool business, having worked in a pump company store and a manufacturing plant before entering the accounting field. Prior to coming with Fluid Packed Pump Company, McFadden was treasurer and controller of Axelson Manufacturing Company.

John R. Brennan has been promoted from sales engineer to chief engineer. He will have full responsibility for all phases of company engineering and assist the Manufacturing and Sales departments in furthering the development and sale of Fluid Packed Pump Company products. Before joining Fluid Packed Pump Company in 1948, Brennan spent 11 years with the Union Oil Company as a field engineer and production foreman.

Curtiss Named Vice President Of S. M. Jones Company

Colman Curtiss, Jr. of Buffalo, N. Y., has joined The S. M. Jones Company, Division of Buffalo-Eclipse Corporation. He will be a vice president of the Jones Company, succeeding the late Frank S. Oatman.

Colman Curtiss, Jr.

Curtiss has been with the Buffalo Bolt division of the Buffalo-Eclipse Corporation for 20 years, except for two years during World War II. He has been sales manager of the Buffalo concern, but will assume general administrative duties with the Jones Company, as he has a manufacturing background of production and accounting in addition to sales.

Joy Manufacturing Elects Lawrence Vice President

Joy Manufacturing Company announces the election of John Lawrence as executive vice president. In addition to assuming the responsibilities normally associated with his new post, Lawrence will give special attention to Joy efforts toward further diversification of the company's product lines.

Lawrence joined the company in 1951 as vice president—manufacturing and was named vice president—manufacturing and engineering in 1953. His prior experience includes seven years with SKF Industries, Inc., where he served as vice president and 10 years as factory manager with Jones and Lamson Machine Company.

Gaso Pump & Burner Names Pacific Coast Distributor

Gaso Pump & Burner Manufacturing Company, Tulsa, announces the appointment of Power Pumps, Inc., as Pacific Coast distributor for Gaso pumps. Headquarters of Power Pumps, Inc., are at 3273 Cherry Avenue, Long Beach, where complete stocks of Gaso pumps and parts will be maintained.

The new distributing company is headed by Ralph Abbott and associates. Abbott has had 15 years' experience in the oil fields of California, 13 of them as branch and area manager for Republic Supply Company. For the past two years he has been special manufacturers' representative specializing in products used in the oil and pipe line industries.

Technical Oil Tool Corporation Announces Personnel Changes

Technical Oil Tool Corporation has announced recent changes in the Totco organization. W. Y. (Red) Cadwallader has been employed to serve Totco users in the Bakersfield-San Joaquin, California areas.

P. Taylor Bannerman, formerly with Totco in Bakersfield, has been appointed purchasing agent at the Totco home office and plant in Los Angeles. John Davis has been named California division manager with headquarters in Los Angeles.

To improve customer service in Kansas, Dale Ernest has been moved from Hobbs, N. M., to Pratt, Kansas. Ernest will serve all of the supply stores carrying the Totco line in Kansas.

When you buy STURDYBILT Prefabricated Houses you need never to lose your original investment. Any STURDYBILT House can be moved to your new site, or sold to another company for erecting on its lease.

Check the advantages of STURDYBILT houses, garages, warehouses, tool houses and other buildings before you buy any oil field housing.

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STURDYBILT PREFABRICATED, DEMOUNTABLE HOUSES

SOUTHERN MILL & MANUFACTURING CO. • TULSA, OKLAHOMA

STURDYBILT HOUSES COMPLY WITH COMMERCIAL STANDARD CS125 OF THE NATIONAL BUREAU OF STANDARDS FOR PREFABRICATED HOMES

(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

WITH

RATIGAN

#212

BLOWOUT PREVENTER

The No. 212 is designed for maximum safety and convenience in operation. Manufactured of high-pressure electric steel with 3000 lb. capacity, yet comparatively light in weight. It can also be used for swabbing or running rods in wells that head, or flow, in course of operations. The Ratigan No. 212 Blowout Preventer is equipped with the latest type retractable rubbers . . . simply unscrew the plugs at each end to change. The "212" is manufactured in 2", 2½" and 3" sizes. The 2" and 2½" sizes are supplied both plain and upset and can be furnished in male or female or double female. The 3" size is supplied in male and female only.

Sold through leading supply stores everywhere.

J. P. RATIGAN, Inc.

1213 Santa Fe Ave., Los Angeles 21

Export: National Supply Co., Inc., Export Div.

600 Fifth Ave., New York 20, N.Y.

Le Roi Appoints J. E. Heuser To Vice Presidency of Sales

Le Roi Company has appointed Jack E. Heuser vice president of sales. Heuser will be responsible for the organization and management of a newly-created sales division to sell and service all Le Roi products.

J. E. Heuser

Heuser joined Le Roi in 1939. He became a member of the Ampco Metal sales organization in 1941 and served as manager of the Pittsburgh district and later the Los Angeles district. In 1946 Heuser rejoined Le Roi as assistant to the general sales manager and later became engine division sales manager.

Fluor Names Vice President For Research Division

Dr. William R. Hainsworth has been appointed vice president in charge of the Research division of The Fluor Corporation, Ltd., Los Angeles engineering, construction, and manufacturing firm.

Dr. Hainsworth

Hainsworth joined the company in 1952 and had served since that time as technical advisor to the executive vice president. He was formerly vice president of the Engineering division for Servel, Inc., and is a past chairman of the Industrial Research Institute.

He has also served as president of the American Society of Refrigerating Engineers, and as vice chairman of the Industrial and Engineering Division, National Research Council.

Hainsworth is a recipient of the Munroe Award, presented annually by the American Gas Association for the most outstanding contribution to the gas industry.

Lee Van Horn, formerly vice president —research and development—has assumed the duties of vice president—process and development.

Stewart & Stevenson Services Announces Personnel Promotions

A number of personnel promotions in Stewart & Stevenson Services, Inc. branches throughout Texas have been announced.

E. E. Childress, who has been sales manager of the Odessa branch for the last three years, has been transferred to the main plant at Houston where he will serve as chief engineer. Childress has been with Stewart & Stevenson for eight years.

N. J. (Tiny) Herman has been transferred from the Engineering department in Houston to the petroleum industry Sales department for the Houston territory.

Grady Foster has been transferred to the Lubbock branch where he will be sales manager. He was formerly in the Sales department of the San Juan branch.

Catawissa

PERFECT SEAL

Unions

HOT FORGED from solid, rectangular steel bars, designed and produced for dependable, long-life service under the severest piping conditions!

A TYPE FOR EVERY USE!
FOR ALL PRESSURES!
FOR ALL TEMPERATURES!

Standard & Double Extra Heavy
UNIONS

Available with screwed or socket weld ends. 3000-lb. sizes ⅛" to 3"; 6000-lb. sizes ⅛" to 2".

ORIFICE UNIONS

With screwed or socket weld ends. 3000-lb. and 6000-lb. service.

MALE & FEMALE UNIONS

With steel-to-steel, bronze-to-steel, stainless steel-to-steel or orifice seats. 3000-lb. service only.

Standard & Double Extra Heavy
LUG NUT UNIONS

Hammer-type for quick opening and quick closing.

WRITE FOR CATALOG 11
showing the complete Catawissa line of Perfect Seal Products

CATAWISSA VALVE AND FITTINGS COMPANY

60 Mill St. · CATAWISSA, PA.

K. W. Patterson

J. L. Vint

Unit Rig & Equipment Elects Three New Vice Presidents

Three new vice presidents have been elected by Unit Rig & Equipment Company. J. T. Tucker is now vice president—sales; J. L. Vint, vice president — engineering; and K. W. Patterson, vice president —manufacturing.

J. T. Tucker

Tucker joined Unit Rig in 1953 as general manager of sales. Vint has been Unit Rig's chief engineer, having been with the firm since 1947. Patterson, who joined the company in 1953 as assistant to the president, has been associated with manufacturing of both aircraft and oil field equipment since 1941.

LeBus Rotary Tool Works Appoints Galien Field Representative

L. (Smokey) Galien has been appointed factory field representative for LeBus Rotary Tool Works, Inc.

L. (Smokey) Galien

Galien, who has been associated with the oil industry for 27 years, started as a roughneck with Slim Pierce Drilling Company in 1926 and worked for that company as a driller and tool pusher until he joined the staff of Brown Oil Tool Company in 1941.

With Brown, he served as district manager for that company's Ark-La-Tex area until joining the staff of McCullough Tool Company in 1953. He will make his headquarters at LeBus main plant in Longview, Texas.

Cardinal Chemical Promotes McLaughlin and Ormond

Cardinal Chemical, Inc., has announced the promotion of J. D. McLaughlin, former division sales manager, who is now in charge of over-all engineering and equipment design, plans and installation; and the promotion of James F. Ormond from sales and development engineer to division sales manager. Both are in Odessa, Texas.

United Geophysical Company Ownership Changes Hands

Officers and area managers of United Geophysical Company have formed a new company for the purpose of purchasing the business and assets of the present corporation from the owner, Union Oil Company of California.

There will be no change in the personnel, equipment, laboratory facilities or policies of the new company. The organization will be entirely independent and wholly owned by the active management, with all equipment company-owned.

The resignation of Herbert Hoover, Jr., as chairman of the board of directors, has been accepted. Hoover has been appointed Under Secretary of State, which has necessitated the severing of his connection with the organization of which he was the founder.

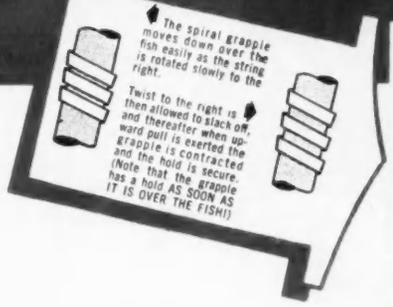
Gardner-Denver Company Moves Into New Building in Dallas

Gardner-Denver Company, manufacturer of equipment for the oil, mining and construction industries, has moved into its new unit fabrication and warehouse building in Dallas. Built to the company's own specifications, the plant will serve Gardner-Denver's activities in the oil industry.

Welex Jet Services Promotes Crice to Sales Engineer

Billy Crice has been promoted to the position of sales engineer with the Beaumont district office of Welex Jet Services, Inc. Crice, who has been with Welex as a rigman and shooter in the company's Victoria and Corpus Christi offices, has several years experience in the oil industry.

"Grapple Grip" OF BOWEN OVERSHOT CATCHES FISH EASIER!


The spiral grapple moves down over the fish easily as the string is rotated slowly to the right.
Twist to the right is then allowed to slack off, and thereafter when upward pull is exerted the grapple is contracted and the hold is secure. (Note that the grapple has a hold AS SOON AS IT IS OVER THE FISH!)

Holds Tighter as Load Increases!

In today's fishing jobs, you can't take chances on weak-kneed tools. It is imperative that you get the pipe out of the hole quickly and safely without further equipment losses!

And when you have a job for an overshot, there's one way to make sure that you get a rock-solid grip every time—a grip that cinches tighter as pull increases. ORDER OUT A BOWEN RELEASING OVERSHOT!

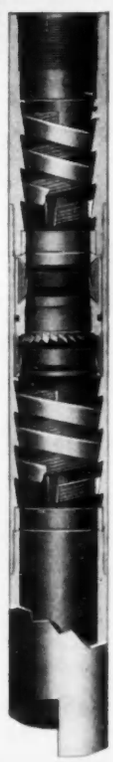
NO SLIPS TO CHANGE . . . NO ADJUSTMENTS

Without changing slips or making any adjustment whatever, this tool catches drill pipe, coupling, or tool joint—whichever is up! As soon as it's over the fish, the spiral grapple takes hold with a full-length crush-proof grip that tightens as pull increases.

An integral milling member rounds up any ragged ends of the fish, and a guide on bottom gets the tool over the fish. Although made with minimum outside diameter for use under tight hole conditions, the Bowen Overshot nevertheless withstands the hardest pulling or jarring operation. And release from the fish, if necessary, is a simple matter of a downward bump, a turn to the right and simultaneous upward movement. It both sets and releases—TO THE RIGHT!

One to as many as four-bowl Overshots can be supplied in the size you need for any job.

Write for descriptive literature!



SR BOWEN CO

MAIN OFFICE AND PLANT:
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SANTA FE SPRINGS, CALIFORNIA
EXPORT OFFICE:
30 ROCKEFELLER PLAZA
NEW YORK CITY, NEW YORK
EXPORT REPRESENTATIVE: VAL P. WITTICH, JR.

(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

Lane-Wells Names Neale President And Durkee Chairman of Board

John J. Neale has been named president, Rodney S. Durkee, chairman of the board, and Walter T. Wells, founder-chairman of Lane-Wells Company. The board of directors has been increased to 11, and Neale has been made a new director, leaving one vacancy to be filled.

Neale, assistant to the president for the past year, started work for the company as a loader in Houston in 1936. He has been a helper, perforating operator, operator-in-charge, sub-district superintendent, division sales engineer, district superintendent, Gulf Coast division sales manager for two years, and Gulf Coast division manager for six years.

Rodney S. Durkee

John J. Neale

Durkee joined Lane-Wells in 1938 as executive vice president after nearly 23 years in an executive capacity with major oil companies. In 1939, he was made president and the company has grown from a comparatively small concern at that time to a world-wide organization with nearly 100 branches. As chairman he will have general supervision over company activities.

Wells, co-founder of the company in 1932, was president until 1939 and has been chairman of the board until the present.

KOHLER ENGINES

4-CYCLE
AIR-COOLED

K160

K90 3.6 H.P.
K160 6.6 H.P.
K330 11.8 H.P.
K660 26.8 H.P.

Kohler Engines are engineered and manufactured to the high standards which have made the Kohler mark known for quality the world over.

Power for garden tractors, pumps, sprayers, snow removal equipment, grain elevators, hoists, portable saws, concrete mixers, compressors, industrial lift trucks.

Write for information

K330

Kohler Co., Kohler, Wisconsin
Established 1873

KOHLER OF KOHLER

PLUMBING FIXTURES • HEATING EQUIPMENT • ELECTRIC PLANTS
AIR-COOLED ENGINES • PRECISION CONTROLS

Security Engineering Division Appoints Gearhart to Post

Marvin Gearhart has been named to the post of head regional field engineer for Security Engineering division, one of the Dresser Industries.

Marvin Gearhart

In his new post Gearhart will supervise Security's network of regional field engineers serving the drilling industry in the Mid-Continent, Rocky Mountain and Canadian oil fields. Gearhart, who is making his headquarters in Fort Worth near Security's new 20-acre Dallas plant, first joined Security in 1953. Prior to his recent promotion, he was Security's chief regional field engineer for the western region.

American Locomotive Appoints Market Research Director

The appointment of Arthur A. Batts, Jr., as director of market research for American Locomotive Company has been announced. He comes to ALCO from the Carborundum Company of Niagara Falls, where he was director of commercial research for seven years.

Arthur A. Batts, Jr.

Batts serves on the advisory council of market research directors of the National Industrial Conference Board. He is also a member of the American Marketing Association.

In his new position, Batts will conduct marketing surveys, suggest product opportunities, provide marketing and economic forecasts and make available various data on business activity. He will make his headquarters at Schenectady, N. Y.

International Harvester Makes Changes in Motor Truck Division

G. D. Partridge, International truck district manager at Cincinnati for International Harvester has been transferred to the Detroit district as manager.

E. D. Maber, formerly assistant district manager, Cincinnati, succeeds Partridge as manager in that district. E. W. Dodson, formerly branch manager, Charlotte, N. C., has been promoted to assistant manager at Cincinnati. R. W. Stiegler, formerly assistant district manager at New Orleans, has been transferred to Dallas in the same capacity. R. V. Ruth, formerly branch manager at Cincinnati, has been promoted to assistant manager of the New Orleans district.

INCREASE PRODUCTION

CLEAN OUT CHOKING SAND

Excessive sand and sediment holds back your oil. For fast, easy clean out with fewer round trips and less down-time, use world famous Miller Sand Pumps.

PUMP & BAILER SIZES
O.D.—2½, 3, 3½, 4¼, 5, 5½, 7 In.
Lengths—20, 25, 30 ft.

Composite Catalog, Page 3433

Write for descriptive price list.

MILLER SAND PUMPS

Miller Sand Pump Co.
General Offices, Box 4516
Oklahoma City 9, Okla.

EXPORT OFFICES
30 Rockefeller Plaza
NEW YORK CITY 20, N. Y.

Mid-Continent Supply Promotes Brown to Sales Representative

Mid-Continent Supply Company has announced the promotion of R. P. Brown from store manager of the company's Bowie, Texas, store to sales representative of the company's Wichita, Kansas, district.

R. P. Brown

Brown went to work with Mid-Continent in 1949 at the Magnolia, Ark., store. Later he was promoted to field salesman and store manager at Magnolia and was transferred to Bowie in 1954.

Lane-Wells Opens New Branch; Announces Personnel Changes

Lane-Wells has opened a new branch office in Pratt, Kansas. W. J. Gray, formerly at Russell, is in charge of the new branch and others named to the staff are R. M. Johnson and Don E. Ruegsegger.

Glen E. Cooper has been moved to Russell to become district superintendent. Cooper, who has been with the company since 1944, formerly was in charge of the Stockton station. He is replaced in Stockton by J. B. Thompson, a Lane-Wells employe since 1947. Before his appointment in Stockton, Thompson was working out of the branch at Russell as perforating and logging operator.

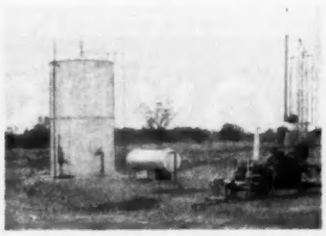
SECONDARY MODERN RECOVERY

TECHNICAL CONSULTING
PRODUCTION ENGINEERING
SERVICE, INCLUDING
CORE ANALYSIS

PRESSURE MAINTENANCE WITH GAS OR WATER

REPRESSURING WITH GAS OR WATER

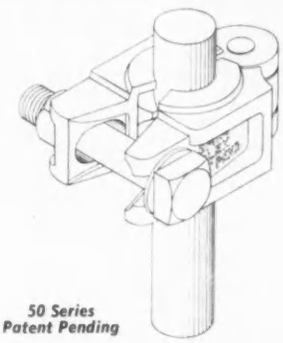
Water Plant For Combination Pressure Maintenance And Disposal For Two Strawn Producing Sands



Clay County, Texas

SURVEYS
ESTIMATES
DESIGN
INSTALLATION
SUPERVISION

PETROLEUM ENGINEERS
CABLE ENGINEERING
WICHITA FALLS, TEXAS



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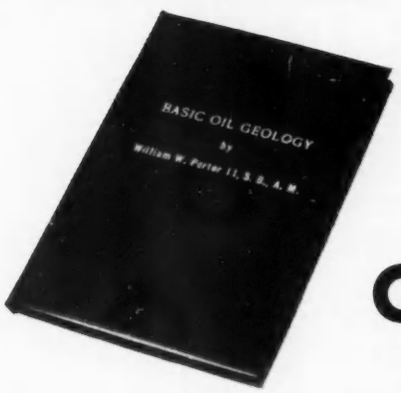
LOW COST GRIP with large, accurately machined supporting surfaces on both sides. Hinged, no loose parts. Certified malleable iron body. We invite comparison of price and performance. Stocked at supply stores.

PARAMOUNT EQUIPMENT CO., INC.
TULSA, OKLA.



new information on . . .

BASIC OIL GEOLOGY

by William W. Porter, II

This concise, easy-reading analysis of geology is a revision of an earlier book, *The Practical Geology of Oil.* The author is a member of the American Association of Petroleum Geologists and a member of the American Institute of Mining and Metallurgical Engineers.

This 144-page cloth-bound book in the handy size of five by eight inches is illustrated with 21 photographs, cross sections, drawings and maps. Subject matter, as indicated by chapter headings, touches upon the fundamentals of geology, elements of an oil field, common minerals, rocks, erosion, geological time, fossils, sedimentation, the crust of the earth, structural geology—folding and faulting, concentration of oil, unconformities, methods of drilling, well logging, coring, formation testers, geophysical methods, productivity of oil fields, and sources of geological information. Price $4.

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(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

Johnston Testers Moves Export Office to Houston

W. F. (Bill) Bettis, vice president in charge of export sales for Johnston Testers, has announced the move of the export sales offices of the company from Los Angeles to Houston.

Bettis, who has been in charge of Johnston's export sales since 1934, stated that with enlarged home office facilities such a move is in line with company policy to locate all personnel in its new building in Houston.

In Houston export sales will be more accessible to the foreign markets and will also have a closer liaison with operating personnel in foreign countries.

FOX IS AHEAD

NEW FEATURES BUILT INTO PORTABLE MAST

Advanced developments designed into the FOX PORTABLE MAST make it your logical buy for efficient and economical operation.

Ask your supply company for new specifications and a quotation on a 133-foot, 625,000-pound capacity FOX PORTABLE MAST. You'll like the new improvements and exclusive features built into this highly successful mast . . . now being used in most major oil fields in the U. S. and Canada.

Fox Diamond Derrick Co.
C. VICTOR THORNTON, President
2700 West Pafford St. P. O. Box 6958
FORT WORTH, TEXAS

Sales Branch Opens

Oil Center Tool Company has opened a new permanent sales and service branch at Casper, Wyo., to serve the Rocky Mountain-Williston area. M. E. (Mike) Hunter is district manager and Harry McDow is sales representative at the new store.

Simms Receives Promotion In McCullough Tool Company

Charles L. Simms has been appointed Eastern division credit manager for McCullough Tool Company. Simms joined McCullough Tool Company in 1945 and was appointed assistant Eastern division credit manager in 1952. Before his association with McCullough Tool, Simms was with Dickson Gun Plant, Houston. In his new capacity he assumes the duties formerly held by James M. Gray, recently appointed assistant vice president.

Charles L. Simms

Geomarine Service International Moves Headquarters to New Orleans

Operational headquarters of Geomarine Service International, Inc., offshore exploration division of GSI, have moved from Dallas to New Orleans. Office address in New Orleans will be 512 Carondelet Bldg.

Neil W. Mann has been made manager of Geomarine, replacing Curtis H. Johnson. Johnson has been transferred to Holland as resident director of Geophysical Service (Nederland) N. V. Mann has held the position of assistant manager in the Geomarine Dallas office for the past year.

Schlumberger Establishes District Office in Louisiana

Schlumberger Well Surveying Corporation has recently established new district offices and a division maintenance center at Gretna, La. The Gretna district is under the supervision of Carl F. Schwab.

Field units which formerly have been located at Harvey have been moved to the new center. The South Louisiana division of Schlumberger is under direction of H. W. True.

Thomas I. Stacy

Jack H. Walters

Rockwell Promotes Houston Men To New Sales Positions

Jack H. Walters, Houston district sales manager of Rockwell Manufacturing Company's Meter and Valve division since 1951, has been named gas products manager for the entire division and will make his headquarters at the company's home office in Pittsburgh.

Thomas I. Stacy, sales engineer in the Houston district since 1940, will replace Walters as district manager.

Walters joined Rockwell in 1943 as a sales trainee in the Houston office. From 1948 to 1951 he served as a sales engineer covering the Lake Charles, La., area. Stacy joined Rockwell in 1938 after graduation from Oklahoma A & M College.

Austin Joins Welex Jet Services As Special Sales Representative

Jack C. Austin, former assistant manager of the Wichita Falls Chamber of Commerce, has been appointed a special sales representative for Welex Jet Services, originators of jet perforating of oil wells.

Jack C. Austin

He is a native of Wichita Falls, was executive secretary of the Junior Chamber of Commerce from 1943 to 1947 before advancing to the Senior Chamber position.

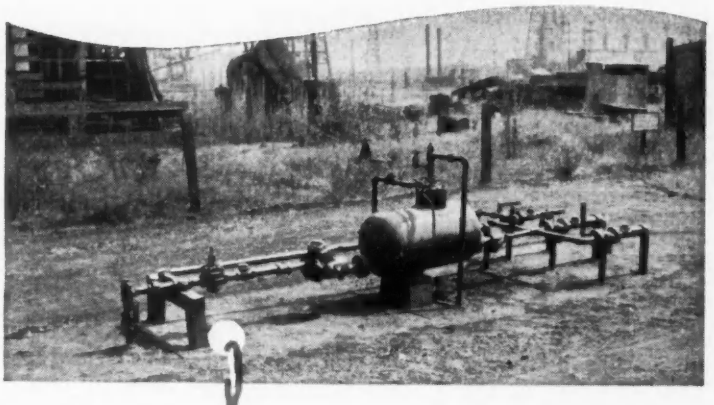
For the past year, Austin has been engaged in a drilling and production operation with a local independent oil operator. He is a member of the board of directors of the North Texas Oil and Gas Association.

Oil Well Supply to Enlarge Facilities at Garland, Texas

Oil Well Supply division of United States Steel Corporation has announced plans for enlarging its central warehouse and modification center facilities at Garland, Texas.

"Oilwell's" present Garland plant, completed in December, 1950, has served as a central stocking point for "Oilwell's" Southwestern operations and has provided certain assembly and modification facilities. Fred F. Murray, president of "Oilwell," said that new merchandising plans of the company influenced the decision to enlarge the Garland operations.

"Oilwell's" Garland plant is located on an 83-acre tract of land on the west edge of the city of Garland and is served by a spur from the main line of the M-K-T Railroad.



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Wherever ground must be kept bare of fire-hazardous weeds and grasses... use BORASCU... the modern, low-cost weed killer! Ease of application and effective results make BORASCU a very wise choice for the long-lasting destruction of unwanted vegetation about your tank batteries, well sites and heater units, etc. Weeds *can't* grow on ground that has been properly treated with BORASCU. Nor do you need special equipment... just a man, a pail, and BORASCU.

CONCENTRATED BORASCU WEED KILLER ®

- NOTHING TO MIX
- NO WATER TO HAUL
- NONCORROSIVE TO FERROUS METALS
- NONPOISONOUS
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Kills weeds for pennies

Saves you Dollars

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Dow Chemical Company Announces Expansion of Research Facilities

Expansion of facilities for latex research and development at its Midland Division is announced by The Dow Chemical Company. The new facilities will be under the direction of J. W. Britton, a company production engineer.

The expansion program includes a Latex Research Laboratory scheduled for occupancy November 1. It will concentrate on the improvement of present Dow latexes and the development of new latexes for applications in the paint and paper coatings fields as well as other industrial uses.

Two other buildings, expected to be completed early in 1955, will be devoted to latex product development, including latex polymerization and production of latex formulations in amounts suitable for customer evaluation purposes.

Dudley A. Taber, who joined Dow in 1937, will be in charge of the laboratory. He has served as an assistant chemist in the organic semi-plant, and as a chemist, project leader, group leader and laboratory division leader.

Max L. Bottomley, with the company since 1946, will have charge of the two product development units. He served four years as a chemist in the organic semi-plant, specializing in latex polymerization research. Since 1950 he has worked on the pilot plant phases of latex process development.

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NOW you can hike profits on your gas distillate wells — large or small — with Russco's miniature gasoline plants. Designed to solve your particular problems, the Micro-Plant and Super-Knockout installations are fully automatic . . . require minimum operating attention . . . and can be economically moved from one lease to another.

These miniature absorption and extraction plants operate at either high, medium, or low pressure. Depending on the nature of your well, their highly efficient multi-fractionation processes furnish top recovery of such materials as propane, butane, gasoline . . . and at the same time accomplish dehydration.

Whatever your present production, the Russco Super-Knockout (Low-Temperature Processer) or Micro-Plant (Larger Unit) will step up recovery enough to pay out quickly and give you an excellent profit increase.

For complete service, from design to operation, write or call —

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R. E. McCullough

Arthur McLawhon

McLawhon Named Comptroller Of Republic Supply Company

Republic Supply Company, Oklahoma City has established a new top management position and elected a new vice president to fill the post. Arthur McLawhon, formerly assistant to the president, was elected a vice president and assigned the newly established responsibility of comptroller of the company.

R. J. Hood

Other promotions announced simultaneously include R. E. McCullough to assistant to the president. Formerly purchasing agent, McCullough will provide top management assistance on high-level negotiations and purchasing contracts.

R. J. Hood, formerly associated with Brown & Root, Inc., Houston, was named purchasing agent to fill the vacancy left by McCullough's promotion. With Hood's appointment, inventory control and the purchasing functions of the Sales, Quotation and Expediting division and the mail and stationery section were added to the purchasing agent's duties.

Gardner-Denver Company Opens New Dallas Plant and Warehouse

Gardner-Denver Company has moved into its new unit fabrication and warehouse building in Dallas, Texas. Built to the company's own specifications, the plant will serve Gardner-Denver's activities in the oil industry.

All of the special units using the company's oil pumps and gas compressors for that area of the oil industry will be fabricated according to the customers' requirements at the Dallas plant. In addition, storage facilities exist in the new building for service parts for all of the company's oil products.

The new building is a one-story concrete and brick structure, strategically located in the heart of the oil industry. It will occupy approximately 17,000 square feet of floor space and can be expanded if necessary.

Lane-Wells Transfers Jones to Oklahoma City

Norman C. Jones, formerly radioactivity engineer with Lane-Wells Company at Casper, Wyo., has been appointed Mid-Continent division field engineer and transferred to Oklahoma City.

Sammie N. Conley, formerly radioactivity operator, has been appointed a district sales engineer trainee in the Rocky Mountain district at Newcastle, Wyo.

WORLD OIL'S Trading Post

CLASSIFIED ADVERTISING

RATES: Regular Classified (undisplayed) set in this size type: 12 cents per word. Minimum charge, $3. Blind box address in our care counts six words. Replies forwarded without charge. **Situation wanted** ads, 6 cents per word. **Display ads,** set in suitably larger type with ruled border, $12 per column inch; situation wanted display ads, $6 per column inch. Ten percent discount for two or more insertions of same copy in consecutive issues. **All classified ads payable in advance. COPY DEADLINE:** 5th of month preceding date of issue. Send copy and checks to: **Trading Post Section, World Oil, P. O. Box 2608, Houston, Texas.**

FOR SALE

WILSON ATLAS
Sales Price—$21,000.00

Equipped with two L1-600 Cummins Diesel Engines in good condition: includes pump drive, 12 PD groove sheave and V-belts. One American cathead and one plain spool cathead. Compound enclosed oil-bath. Includes one 1000 gal. fuel tank. Contact Cardwell—Houston.

GASOLINE PLANT FOR SALE

Gasoline Plant, located in Brazoria County, Texas, shut down in January, 1954. Had been processing approximately thirty-three million feet of gas daily with absorber pressure approximately six hundred thirty pounds. Plant recovered Propane, Butane, Gasoline, Kerosene and Diesel Oil. Adequate storage tanks for all products. Drum Lead Blending Plant. Detailed inventory available upon request.

SOUTHERN PRODUCTION CO., INC.
P. O. Box 670, Ft. Worth, Texas

FRANKS MODEL 5000 Spudder—Serial No. 866
Sales Price—$7,500

Equipped with one Cummins HB1-600 Engine in good condition. Brake rims in fair condition; Brake blocks—Good. General appearance—Good. Chains—Good. Basic Machine equipped with Spudding attachment, Skid and 65' Double Leg Pipe Mast with 8⅝" and 7" Pipe Legs; 4-Sheave Crown of Wilson Manufacture. Price includes Mast Guy Lines.

Location of Unit—Western Kansas
Contact Cardwell—Wichita

WILSON GIANT—Serial No. 6383
Sales Price—$6,000

Equipped with Two Waukesha 145 GK Engines in good condition. General appearance—Fair. Rig used for Work-Over. Price includes Kelco Spinning and Foster Breakout Catheads; Stromberg-McCreary Air Starters on Engines. Brakes circulating water-cooled; Manual Friction Clutches in Transmission; Others—Jaw Clutches. Rig has Slush Pump Drive and Rotary Drive.

Location of Unit—Lake Charles, Louisiana
Contact Cardwell—Houston

For Sale

EMSCO GB 800 RIG

This rig fully equipped with many extras. Less than 45,000' of hole drilled with rig and accessories since new. Inventory includes grooved drum, dynamatic brake, heavy duty mast, 12 foot substructure, 2 pumps including Gardiner Denver 800 H.P. GXR, 3 LRDU Waukesha Diesel Engines, Steel Mud Tanks, 4½" Grade E Hand Banded Drill Pipe, 6¼" and 7¾" Drill Collars. This rig is priced right. For details contact Box 32-W, c/o WORLD OIL, Houston 1, Texas.

FOR SALE

■ Have 3500 acres undeveloped acreage and twenty producing wells in Kevin-Sunburst Field, Montana. Will send and/or make a good deal for drilling capital. Phone 2162 or write Ray Sorrell, Shelby, Montana.

SERVICE

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It pays . . . to know . . . where the oil accumulation lies . . . before you invest, lease or drill.

CARRILLO'S electronic method for oil exploration is capable of detecting the presence of an oil accumulation . . . directly.

CARRILLO'S surveys put the drill on the oil.

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■ 20,000 ACRES IN IDAHO. Good geology. Oil and gas proved in area recently less than 2,000 feet. YOUNG AND CRITCHLOW, 1975 NW Everett Street, Portland, Oregon.

HELP WANTED

Experienced Sales Manager Wanted to organize sales division for a new oil field and pipeline unit. Must have experience with specialty salesmen and supply house contacts. Age 28 to 40 and capable of earning $25,000 per year. Box 36-W, c/o World Oil, Houston, Texas.

■ WANTED OIL WELL DRILLING CONTRACTOR to perform important drilling work of oil wells having depth of approximately fourteen thousand feet. Write: Box 39-W, c/o World Oil, Houston 1, Texas.

■ Seismograph Party Chief for small aggressive company. Minimum five years experience. Send transcript of college credits and brief outlining experience. Opportunities unlimited. Replies confidential. Box 35-W, World Oil, Houston, Texas.

■ Petroleum Engineer, preferably recent graduate for Louisiana Gulf Coast work. Duties to require assistance in preparation of reservoir studies, evaluation and routine engineering reports. Work located in New Orleans with reliable and financially strong concern. Reply giving age, previous experience, if any, military status, and salary desired. Inquiries will be kept strictly confidential. Our employees know of this ad. Box 38-W, c/o World Oil, Houston, Texas.

SITUATIONS WANTED

35 year old family man with 18 years oil field supply experience in field, office and executive positions for same company seeking administrative position in supply or related industry. Available now to locate in Southwest. Call or Write Bernard Jones, 1820 Drakestone, Okla. City, Okla.

SITUATIONS WANTED

Man mature in years, experience and judgment wants connection with active organization, Houston area. Experienced oil field equipment management and sales, oil marketing, and various phases of industry. Valuable connections in these and allied lines. Direct inquiries to Box 37-W, c/o World Oil, Houston, Texas.

BUSINESS OPPORTUNITIES

Well organized, well established oilwell drilling contractor desires the management and supervision of oil properties in West Texas, Central Texas, and New Mexico. Can provide complete handling of oil properties, from acquisition to production. No properties too small, and none too large to handle. Inquiries from independents, groups, small or medium sized oil companies invited. Write, wire, or call collect for further information.

MAKIN DRILLING COMPANY

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Phone 3-3141 — Phone 2-2962

WANTED TO BUY

■ ROTARY DRILLING EQUIPMENT in good working condition, drilling capacity 5000-10,000 feet wanted. Write William Cowan, 11 Riverside Drive, New York 23.

GEOPHYSICAL SERVICE

OIL LOCATING SERVICE!

Determine approximate depth and thickness of oil zones. Drilling locations pin-pointed. NO OTHER GEOPHYSICAL WORK NEEDED! Documentary proof of success. WORTH INVESTIGATING! YOUNG AND CRITCHLOW, 1975 NW Everett, Portland, Oregon.

MAPS OR MAP SERVICE

■ GEOLOGICAL MAPS and FILM. West Texas and southeast New Mexico. Scale 1" = 8,000'. One set Permian datum, one set Pre-Permian datum. Sample and electric log datum. (Also film without datum). BASIN OIL MAP SERVICE, 1600 Bedford Drive, Midland, Texas.

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF WORLD OIL, published monthly at Houston, Texas, for October, 1954.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher Ray L. Dudley, 3371 Chevy Chase, Houston, Texas; Editor and Editorial Director, Warren L. Baker, 5324 Cherokee, Houston, Texas; Managing Editor, Al Reese, 9112 Westview, Houston, Texas; Business Manager, A. L. Burns, 7 Chelsea Place, Houston, Texas.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.) The Gulf Publishing Company, Houston, Texas; James Anderson, Houston, Texas; June Wooden Bliss, Houston, Texas; June Wooden Dudley Bliss—Trustee, Houston, Texas; A. L. Burns, Houston, Texas; Mrs. Grace C. Carter, Tulsa, Oklahoma; Mrs. Margaret D. Cashman, Houston, Texas; P. Stinson Dudley, Gainesville, Texas; Ray L. Dudley, Houston, Texas; Wm. G. Dudley, Houston, Texas; Wm. V. Gross, Fort Stockton, Texas; Carolyn Dodson Keeble, Pecos, Texas; Mrs. Anita S. Lane, Houston, Texas; Charles H. Lane, Houston, Texas; James William Nelson, Baytown, Texas; Tom W. Nelson, Houston, Texas; J. Kent Ridley (Deceased), Houston, Texas; Walter Gage Sterling—Trustees, Houston, Texas; O. R. Waller, Chicago, Illinois; Mrs. Patricia McFarland Windham, Austin, Texas.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) M. D. Anderson Foundation, Houston, Texas.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required from daily, weekly, semiweekly, and triweekly newspapers only.)

WARREN L. BAKER, Editorial Director.

Sworn to and subscribed before me this 16th day of September, 1954.

P. J. AUCOIN.
(Seal) Notary Public in and for Harris County, Texas.
(My commission expires June 1, 1955.)

(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

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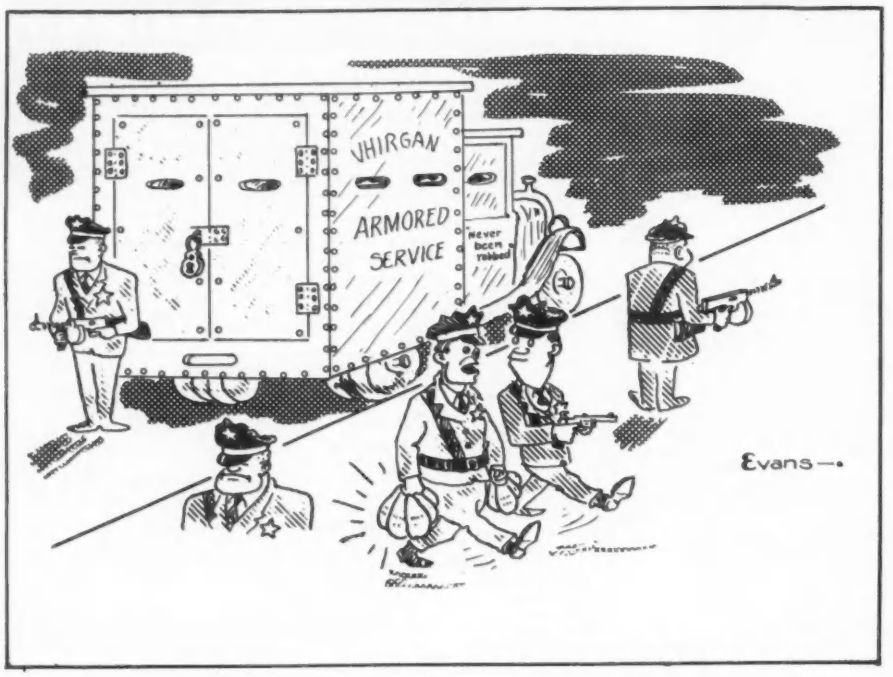
SQUEAKS from the BULLWHEEL



No, it's not gold! It's just some samples from that tight hole in Ector County.

Lots of 'em

He was big, he was rough. He had cut his teeth on a buck bit and standing in the middle of the floor he began shooting the lights out and shouting, "All you dirty S.O.B.'s get out of here!" The bar was virtually emptied in one wild burst of confusion, but as the smoke cleared away it revealed an imperturbable little man calmly finishing his drink at the bar. The tough man lumbered over to him. "Well?" he demanded.

Said the other, "Sure was a lot of 'em, wasn't there?"

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★ POSITIVE ACTION
★ ACCURATE TIMING
★ HEAVY DUTY CASE
★ SIMPLE OPERATION
★ FULLY AUTOMATIC

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GOTKOOL WATER CAN
Made in 1½, 2, 3, 5, 10, 15 and 20 gallon sizes. Push-Button Faucet at slight additional cost.
KEEP PURE DRINKING WATER ALWAYS HANDY
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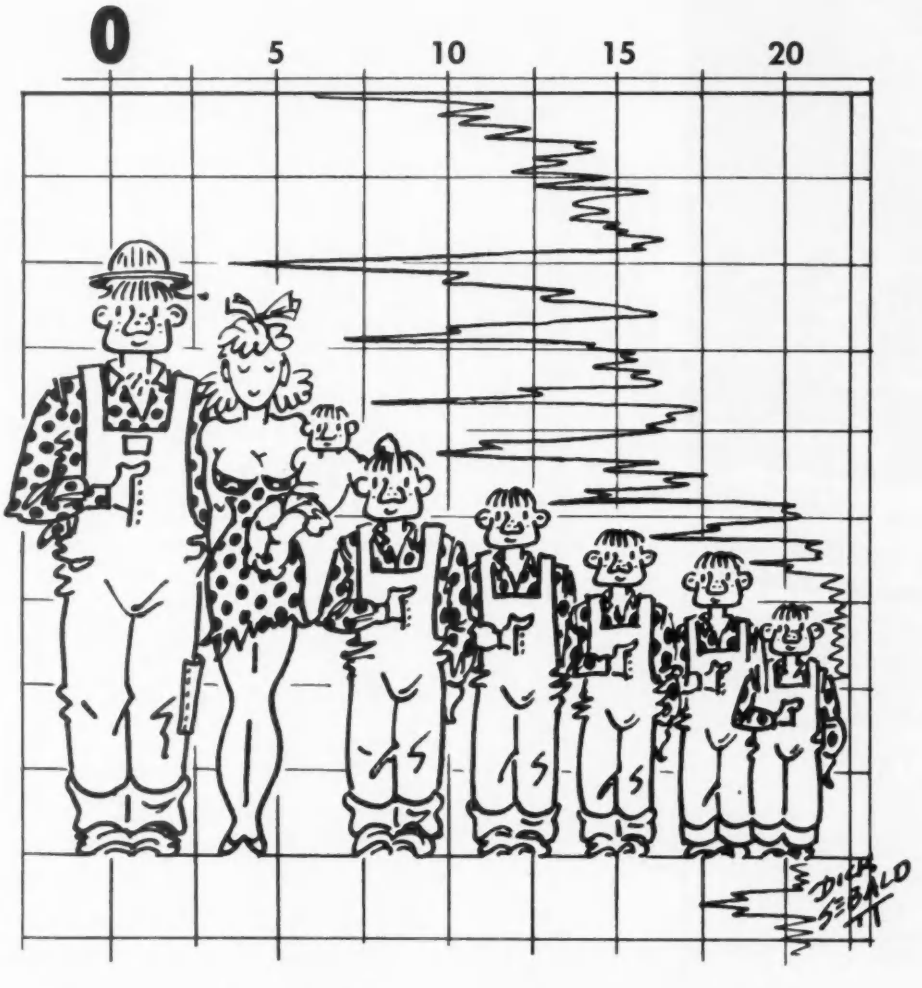
Made in 2, 3, 5, 8, 10, 15 and 20 gallon sizes with Push-Button Faucet.
GOTT Water Coolers are the convenient way to keep drinking water handy to the worker, protect it from impurities. Their exclusive construction keeps water cool for long periods. Snug-fitting, large, removable top, handy non-leaking push-button faucet. GOTT Water Cans for handy field use. Your supply store has them, get one today!
STANDARD OF THE OIL FIELDS
Insist on the Genuine
GOTT
PURE WATER
H. P. GOTT MFG. CO.
WINFIELD, KANSAS

Calibrated from Absolute Zero



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WITH SCINTILLOMETER® • GAMMA RAY • NEUTRON CURVES

Most accurate, reliable and efficient logging instrument available – has greater stability; provides more detail; assures more accurate quantitative interpretation; simultaneous recording of collar log simplifies "pin-point" perforating later. Write for details.

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OVER 40 OIL FIELD SERVICE BRANCHES

SERVICE ANYWHERE—ANYTIME

FOR BEST RESULTS LOG AND PERFORATE BY McCULLOUGH

SPEED UP IGNITION REPAIRS WITH A WICO magneto overhaul PACKAGE

The essential parts for a thorough, long-lasting magneto overhaul are contained in Wico's new XH magneto overhaul package. When you use the complete package, you get a thorough magneto overhaul. All the necessary, factory-made parts for each repair are right at hand—in one package, under one number, at one price. Besides insuring better repairs, the package saves time spent looking for parts, looking up part numbers, figuring out prices. Time saved this way means your engine is back on the job fast, repair costs are lower, profits are up.

OIL FIELD EQUIPMENT gets back on the job fast when a Wico XH magneto overhaul package is used. Package contains all necessary XH magneto parts for thorough, long-lasting repairs: condenser and contact set, gaskets, screws, breaker arm lock, oil seal, slinger, bushing. ORDER PKG. NO. K-9358.

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Box 710, West Springfield, Mass.

Gentlemen:
I can use XH Magneto Overhaul Package No. K9358. Rush me name of distributor nearest me.

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COMPANY .....

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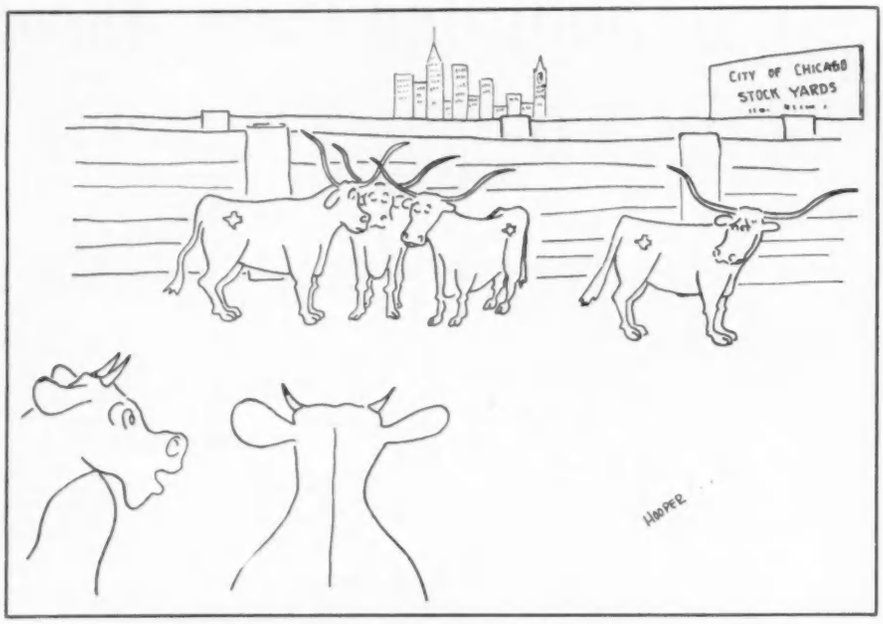


They don't get along anymore. He comes from a ranch that has no oil wells on it.

Anybody But

A candidate for county sheriff was soliciting votes in a small town in Oklahoma. After giving an attentive man a fervent campaign speech, he asked for his support.

"Well, mister, I tell you, you are my second choice," replied the man.

The would-be sheriff pondered a moment. Then concluding that he could not easily eliminate his first choice by maligning the man, he asked cheerfully.

"And who's your first choice?"

"Well, sir, just anybody."

•

A Sure Cure

A widow who had married a widower was asked by a friend how it was working out. "I imagine," said the friend, "that he often talks about his first wife."

"He used to," said the other, "but I cured him of that."

"How?"

"I started talking about my next husband."

•

The British Way

An American meets an elderly Britisher in a sporting club.

A. Care for a game of checkers?

B. No. Tried it once, didn't like it.

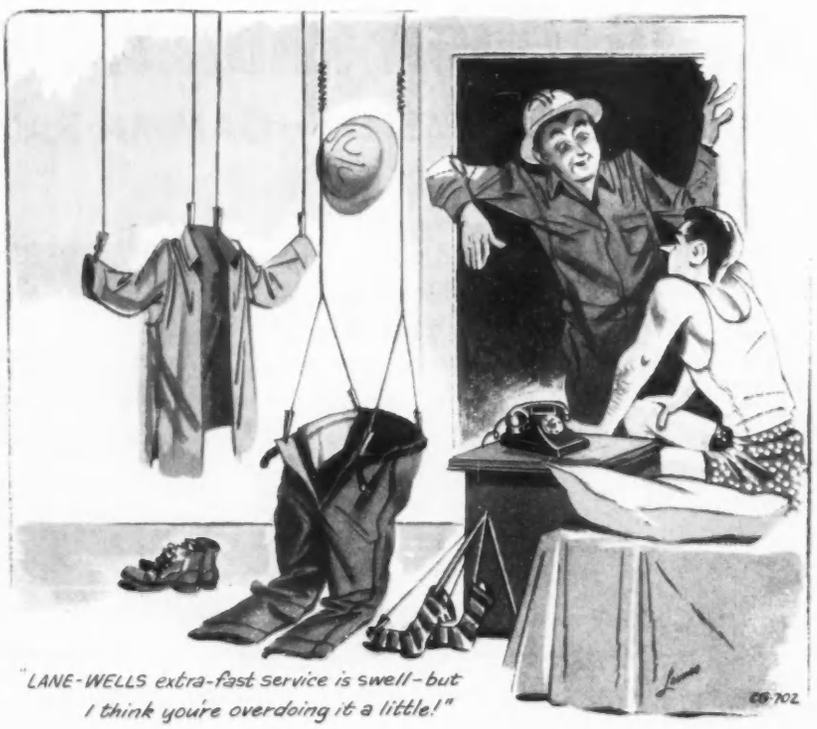
A. Care for a game of chess?

B. No. Tried it once, didn't like it.

A. Care for a game of tennis?

B. No, but my son will play tennis with you.

A. Your only child I presume?



"LANE-WELLS extra-fast service is swell-but I think you're overdoing it a little!"

Going Crooked?

Let's do some straight thinking about straight hole!

If you are running 15,000# to hold 3° in an 8¾" hole with 6¼" drill collars, by placing a Drilco rubber stabilizer 65'-70' above the bit, you can increase the weight to 20,000# and *still hold 3° in most areas.*

Think what this 5,000 pounds more weight in a crooked hole zone would mean to you in

feet of hole per day—
and in dollars per day!

Drilco Stabilizers will help you make money in drilling straight holes in crooked zones.

Give them a try!

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Precaution

The cars having collided, Jock and Pat were surveying the situation. Jock offered Pat a drink. Pat drank and Jock returned the bottle to his pocket.

Pat—Aren't you going to have a drink yourself?

Jock—Not until the police have been here.

•

This America

A Russian spent a year in America and returned to tell his adventures to his friend. "Boris," he said, "if you like it here you should see America. You drive about in a limousine for free. You stay in beautiful rooms for free."

"All this happened to you?" asked the amazed Boris.

"To me, no; but to my sister, yes."

•

Sure Sign

"I think I'd better take the rest of the day off," the cashier said, "and go to the beauty parlor. Guess I'm not looking my best."

"Take part of the day off?" the boss protested, "why you look alright to me."

"Yes," she explained, "but the customers are beginning to count their change."

•

Bad Drouth

A couple of cattlemen discussed the drouth . . .

"Just how bad are things with you?" asked one.

"Pretty tough," the other cowman replied. "My cattle are so thin that by using carbon paper, I can brand two at a time."

So Weak

A man is never so weak as when some woman is telling him how strong he is.

•

American Lovers

"American gentlemen are very poor lovers," said the little French lady sadly, with a kind of fin de siecle weariness hovering over her eyes. "They always want the entree before the hors d'oeuvres."

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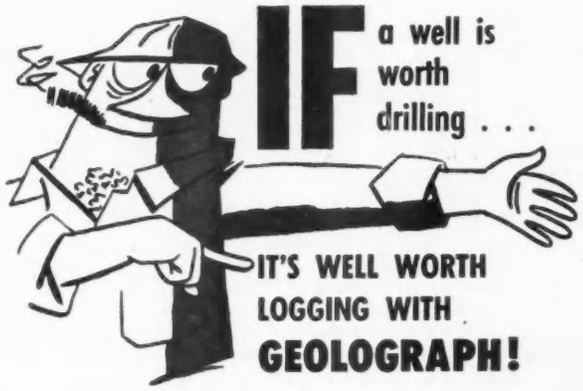

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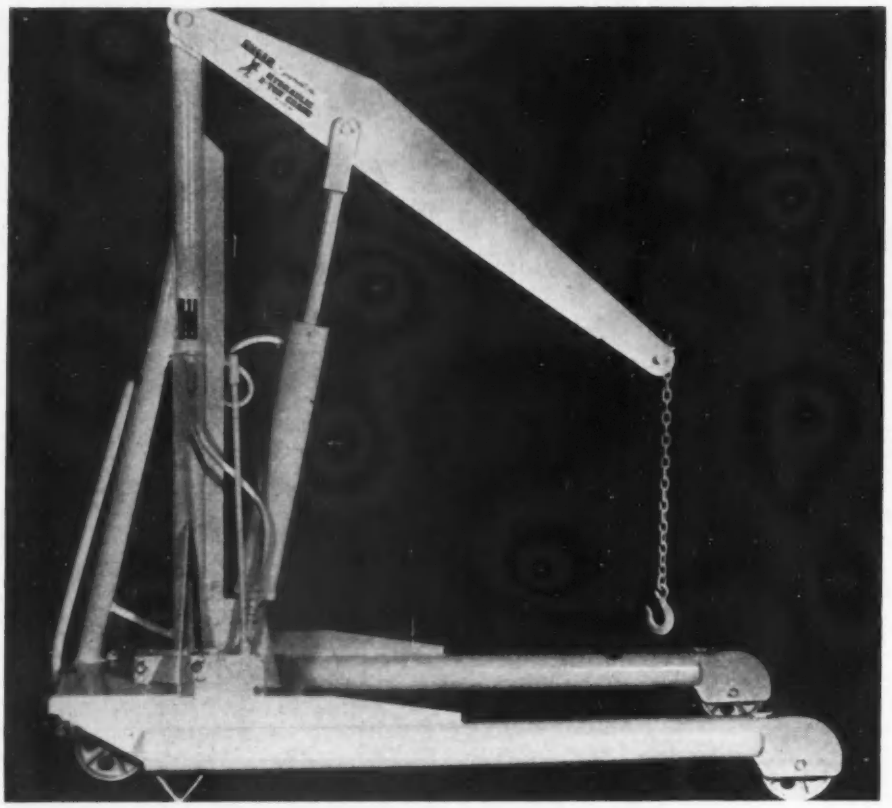


Hydraulic Cranes

The National Supply Company has been appointed exclusive distributor to the Petroleum Industry of Ruger Hydraulic cranes—a product of Ruger Equipment, Inc. Included in this line are floor cranes in ½, 1, 2 and 3-ton capacities, as well as truck cranes in ½, 1 and 2-ton capacities.

The standard two-ton floor crane shown is 2 feet, 11 inches wide with a space of 2 feet, 1 inch between the legs. It is 6 feet, 6 inches high with the boom horizontal, or 9 feet 1 inch high with the boom at its highest position. Other models are available for high lift jobs and for straddling heavy jobs where there is no floor clearance.

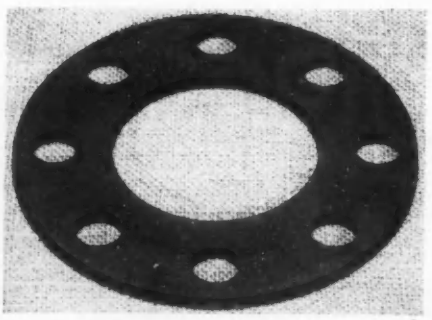
For more data circle **No. E1** on Readers' Service Card, last page this issue.

Flange Protector

A flange protector which forms a protective seal against corrosive elements and offers a number of other advantages has been introduced by Oil Center Tool Company.

The new protector can be applied between any two flange segments on christmas trees eliminating outer guard rings. No maintenance or lubricants are required after the protector is installed. Simple to install and durable for permanent protection, it flows under pressure to allow positive flange make-up. This new flange protector is made of Hycar and is available in a complete range of sizes through 16-inch Series 900.

These protectors are also adaptable for use on flanges at tank batteries, refineries, pump stations, loading docks or other installations where it is desirable to protect ring joints and bolt studs.



(This item supplements Oil Center Tool Comany data on pages 3833-3864 of the Composite Catalog, 20th Edition.)

For more data circle **No. E2** on Readers' Service Card, last page this issue.

Automobile Safety Belt

Miller-Elliott Manufacturing Company is producing an automotive safety belt. Easily attached to the automobile by means of ⅝-inch welded eye bolt, the belt is made of nylon webbing and has been tested to withstand a pull of more than 3200 pounds. The belt is fully adjustable and features a safety buckle and tab arrangement designed for split-second release. Complete details are available on this new product now.

For more data circle **No. E3** on Readers' Service Card, last page this issue.

Lightweight Winch

A new lightweight winch has been added to the line manufactured by Tulsa Winch, Division of Vickers, Inc. Called Model 5, the new winch is just 11 inches high and weighs only 80 pounds, yet is powerful enough to operate with a safe working load of 6000 pounds. It has a high (60 to 1) worm gear ratio which permits direct drive from the source of power and eliminates the need for a worm brake. The new winch can be installed in any convenient location.

Drive power may be provided by a small hydraulic or electric motor or power take-off. The Model 5 is easily adaptable for any installation since it can be driven from the right or left side of the transmission without any disassembly. Complete details and technical information on this new winch now.

(This item supplements Vickers, Inc., Tulsa Winch Division data on pages 4984-4985 of the Composite Catalog, 20th Edition.)

For more data circle **No. E4** on Readers' Service Card, last page this issue.

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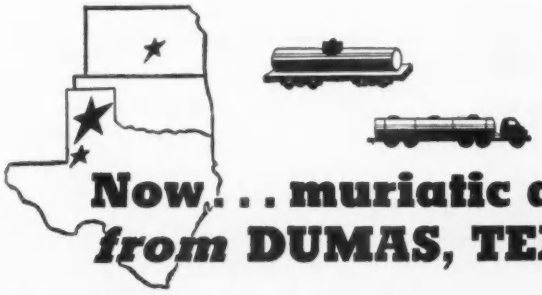

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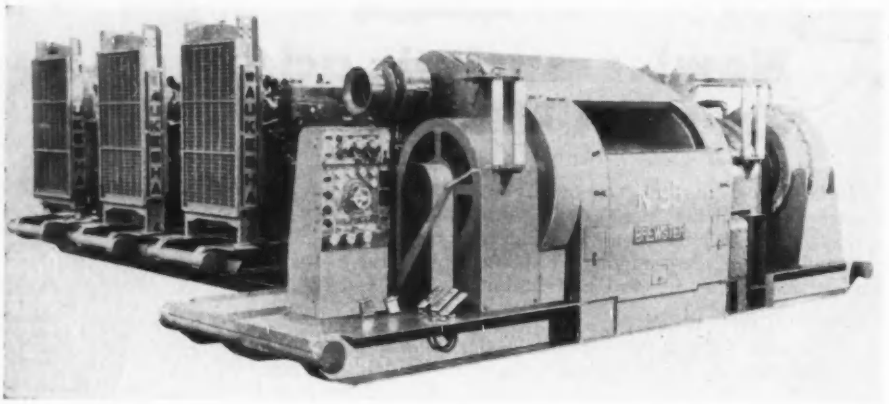

Drawworks

Already in the field making hole, the new Brewster 1200 hp N-95 offers 14,000-foot drilling with a drawworks that can be moved as a single package.

Controls, transmission, rotary drive, and hydromatic brake are all mounted on the main skid. The new drawworks is available in a wide selection of horsepower combinations in a choice of direct mechanical, fluid coupling or torque converter drive arrangements.

Equipped with Brewster's "graduated power" transmission, the N-95 has 8 forward and 1 reverse speed to the rotary. Pump speed can be easily maintained at maximum without increasing rotary speeds. The compound is fully oil bathed with pressure lubrication on all shafts, chains and bearings. Dual in-line V-belt pump drives at rear of compound simplify rigging-up and manifolding and eliminate the need for idlers or notching the substructure. Complete details are available on this new drawworks now.

(This item supplements The Brewster Co., Inc. data on pages 905-940 of the Composite Catalog, 20th Edition.)

For more data circle **No. E5** on Readers' Service Card, last page this issue.

Bulk Handling Equipment

Delta Tank Manufacturing Company, Inc., has announced that it has completed development of a full line of equipment designed for the transport and handling of barite, cement and other types of dry granular products.

The new Delta units include a portable two-screw product conveyor identified as the "Delta Ba-zooka," a watertight steel plate container which carries up to 5000 pounds of barite, and a giant mud hopper with a 540-foot cubic foot capacity.

Designed for use wherever granular products are handled in bulk form, the "Ba-zooka" is powered by a self starting

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two-cylinder Wisconsin engine. Its two screw conveyors are supported by anti-wear sealed bearings. The two-screw design permits the feeding hopper to remain level with the ground at all times regardless of the delivery angle of the elevating screws.

The "mud-hopper" will store up to 70,000 pounds. It is made of 3/16-inch steel plate and weighs approximately 5000 pounds. The mud hopper is 14 feet tall and measures 9 feet in width and has a depth of 7½ feet.

The third new Delta product, the Delta shipping container, was designed for the bulk handling, storage and shipping of all types of dry granular products. Five feet, 10 inches high, and 38 inches in width and depth, the shipping container weighs approximately 750 pounds and will hold some 5000 pounds of barite, cement, or other dry products. It is currently being used to deliver barite, etc., to offshore drilling operations. Complete details on these new items are available now.

For more data circle **No. E6** on Readers' Service Card, last page this issue.

Fuel Oil Filter

American Bosch Division of American Bosch Arma Corporation is now producing a new and improved fuel oil filter for final-stage use on diesel engines. Designated as Type FSA-10A-1, the filter removes from fuel oil, the last tiny particles of dirt which, although microscopic in size, can cause expensive wear on the internal lapped surfaces of diesel fuel injection equipment.

The new filter removes abrasive particles down to those less than 2 microns in size and becomes more efficient with use.

Meet the Widest Range of flow measurement requirements with AMERICAN-WESTCOTT A-88 ORIFICE METERS

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American A-88 standard mercury type orifice meters for working pressures to 5000 psi. in interchangeable 10, 20, 50, 100 and 200-inch ranges give you complete versatility to meet any flow measurement requirement. Integrating instruments integrate both static and differential pressures giving totalized flow indications and telemetering equipped instruments transmit integrated indications to remote locations.

Recording Meters may be equipped with standard O-150°F. Temperature Elements, as illustrated, giving you every advantage of better temperature measurement with speed, accuracy, simple installation, economy and freedom from maintenance.

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- Minimum Simple Maintenance—easy access to float lever arm during calibration.
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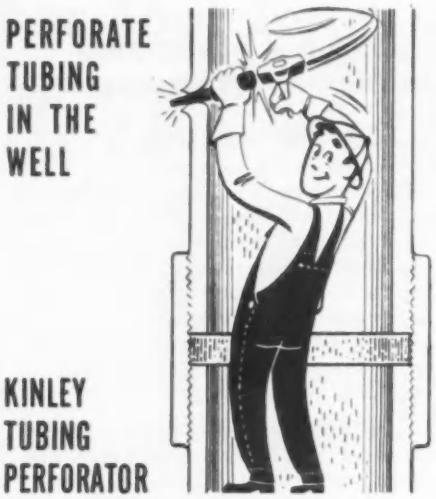
(For more data on advertised products, use Readers' Service blue cards, last page this issue.)



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It is of sealed construction to provide the utmost protection against entrance of dirt into the fuel system when it is replaced.

As an additional safeguard, a built-in check valve is provided to prevent the possibility of incorrect installation as regards direction of oil flow. The filtering element is water resistant, so that if any water should be present in the fuel oil, the filter's effectiveness will not be impaired. Complete details on this new filter are available now.

For more data circle **No. E7** on Readers' Service Card, last page this issue.

Powered Swivel

S. R. Bowen Company is announcing the new type Bowen powered swivel. This new unit develops a speed of 80 revolutions per minute in high gear and a speed of 40 rpm in low gear—an increase in speed of more than 85 percent over the speed developed by Type C Bowen powered swivel. The torque that this new unit develops is approximately the same as that developed by the Type C swivel. With the addition of this new unit to its line, the S. R. Bowen Company now offers to the trade three sizes of Bowen powered swivels. All of these are available as either skid mounted units or as trailer mounted units. Full and complete technical details and specifications are available on these new units now.

(This item supplements S. R. Bowen Company data on pages 825-868 of the Composite Catalog, 20th Edition.)

For more data circle **No. E8** on Readers' Service Card, last page this issue.

PRODUCTION

Fuel Generator

A unique fuel generator which converts a fraction of the crude oil from a well or pipe line into fuel for internal combustion engines has been developed and is being manufactured by Carbro, Inc.

The Carbro generator draws a small amount of crude from the gun barrel on a pumping well or from the pipe line. The exhaust gas from the internal combustion engine heats the Carbro fuel generator which separates a small amount of volatile gasses from the crude. This gas is stored in a volume tank which is connected to the carburetor of the engine, or in the same place that costly butane or natural gas is connected. The generator operates at a pressure at or slightly below atmospheric and at a temperature never above 160° F.

Carbro fuel generators are available in two models. Model 20 for use on engines up to 40 horsepower, and Model 100, for use on engines from 40 to 100 horsepower. The average installation time for the Model 20 is about two men for one-half day and for the Model 100—two men for about two days.

For more data circle **No. E9** on Readers' Service Card, last page this issue.

Casing Scraper

A new type of scraper, called the Bowen-ITCO hydraulic casing scraper has been placed on the market. It is a powerful compact unit, having no protruding surfaces other than the blades, no parts fastened by bolts or screws which might shear off or vibrate loose.

Principal parts except the bladder are of high-grade alloy steel. The precision-cast, hard-faced blades fit closely in slots in the body. Integral back-up plates help hold the blades in position. These plates receive the pressure of the bladder which forces the blades outward to their full extent without pump pressure. When circulation is employed, the fluid is conveyed to the bladder through holes in a wash pipe.

The scraper can be rotated or spudded as desired. Pump pressure is normally not necessary, except in a particularly rigorous operation, or to wash out cement or excessive paraffin.

Complete details on this new product are available now.

For more data circle **No. E10** on Readers' Service Card, last page this issue.

Paraffin Remover-Homogenizer

A tool utilizing an entirely new principle in control of paraffin in pumping wells is now in production by Woolley Tool Service. Called the Besse paraffin remover-

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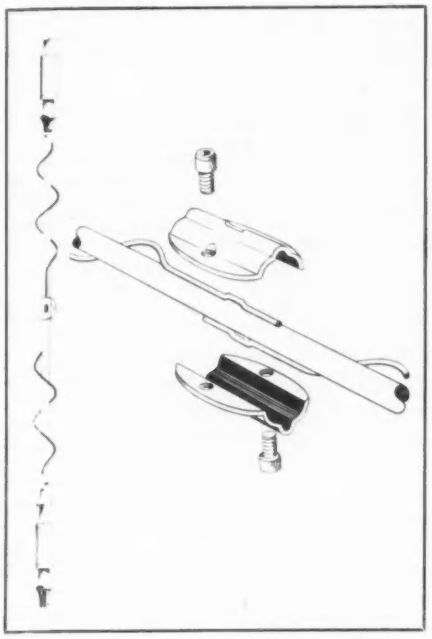


homogenizer, the new unit is said to offer practically every known advantage in construction and design. Essentially, the new tool is a pair of identical rod steel spirals joined at a center clamp to the sucker rod.

Each spiral is coiled to an outside diameter ¼ inch smaller than the inside diameter of the tubing. Spirals are attached to the rod at the clamp end only, and vibrate freely at the free ends with a side-to-side motion which keeps paraffin particles in suspension. The effectiveness of this motion is aided by thorough washing and rinsing in standing well fluids during the downstroke.

The Besse paraffin remover-homogenizer is easily installed at the well site with ordinary tools by any field man.

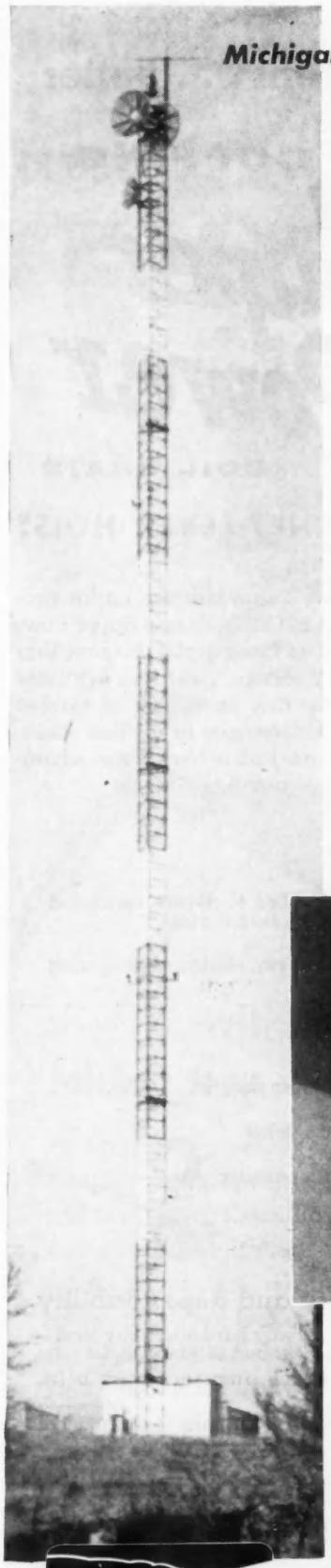
For more data circle **No. E11** on Readers' Service Card, last page this issue.

Rodless Pump

The Sargent rodless pump consists of a standard production pump coupled to and driven by a hydraulic engine valve. The unit is energized by crude oil under pressure which is furnished by any suitable prime mover at the surface. Originally designed for whip-stocked or extremely crooked holes, the Sargent rodless pump provides many advantages for all types of wells both deep and shallow. It permits the installation of a power unit having a maximum lift area in production tubing of a given internal diameter. For a given pumping depth and production capacity, a minimum operating pressure is required. The simplicity of design and the incorporation of standard rod pump ideas facilitates service maintenance and eliminates the necessity of tocking large numbers of spare parts. Field tests for more than six years have provided performance records to indicate pump efficiency and economy under varying well conditions. Copies of these records are available.

(This item supplements Sargent Engineering Corporation data on pages 4409-4448 of the Composite Catalog, 20th Edition.)

For more data circle **No. E12** on Readers' Service Card, last page this issue.



Michigan-Wisconsin Pipeline Company

Assures power for repeater stations with ONAN Standby Electric Plants

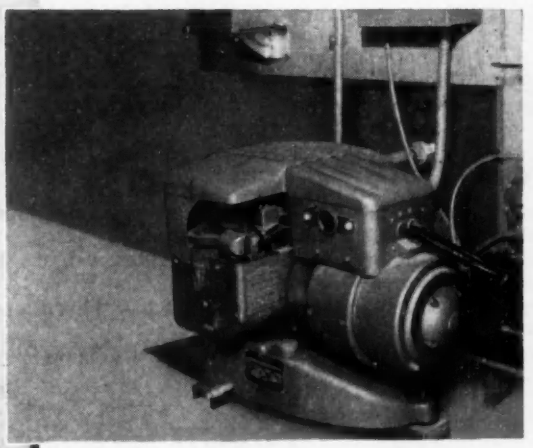
Microwave radio handles communications for the Michigan-Wisconsin pipeline which carries natural gas from Texas fields throughout Wisconsin and Michigan.

Of the 60 repeater stations in the system, 53 are unattended and are equipped with Onan Standby Electric Plants and Onan Automatic Line Transfer Controls. When commercial power is interrupted, the Onan plants start automatically and supply power for operating microwave equipment.

Most of the Onan units are Model 305CK electric plants of 3,500-watt capacity. This model, together with the Onan 5 and 10KW "CW" electric plants have built-in advantages for microwave standby service. They are air-cooled, extremely compact, and dependable.

If you have a problem in standby power, write our sales engineers. Onan builds electric plants for every need . . . from 400 to 55,000 watts.

Onan Model 305CK shown installed in the repeater station at Waukesha, Wisconsin. Bottled gas is used for fuel.



NEW AUTOMATIC MICROWAVE LINE TRANSFER CONTROL

This new control facilitates testing of all control components as well as the engine generator set. Momentary contact switch transfers load from commercial power to the generating plant with only 1/10th second interruption. Generator can be exercised by itself if desired. Control incorporates time-delay starting, stopping Voltage sensitive relays, both on the commercial line and on generator output, assure correct voltage before transferring load.

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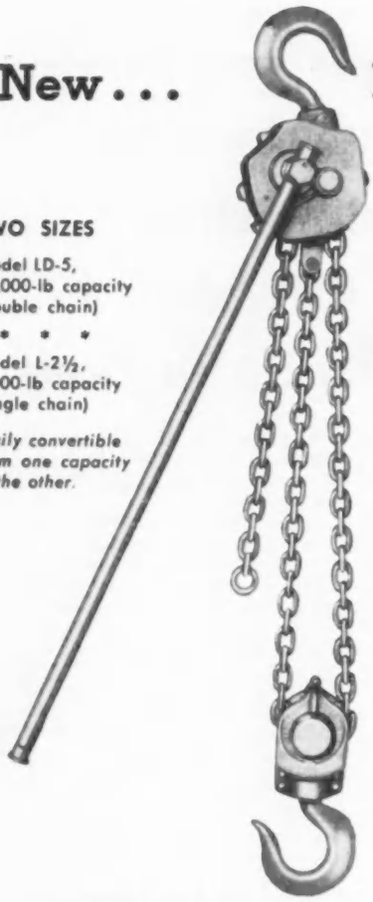
Model L-2½,
5,000-lb capacity
(single chain)

Easily convertible from one capacity to the other.



For over two years the entire production of Coffing's new Super Power Ratchet Lever Hoist has gone into military service. Now it is available to bring new standards of ratchet hoist performance to civilian users. These are just a few of the advantages this new hoist offers:

SIMPLE in design

Parts are simple, rugged and few in number to assure continued top performance. May be disassembled in the field for fast, efficient servicing.

The only 5-ton hoist of this type using but two chains, contributing to faster operation and lighter weight.

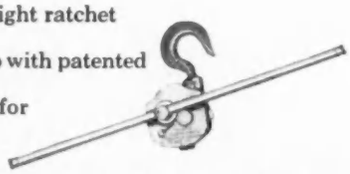
CONVENIENT to use

Handle adjustable for close-quarter applications — also may be operated from opposite side of hoist.

The 5-ton model weighs but 58 lb — lightest weight ratchet hoist in this capacity on the market.

Only 70 lb of handle pull needed to lift 10,000 lb with patented compound lever principle.

You get coil chain flexibility plus free chaining for quick adjustment.



TOUGH for safety and dependability

Ratchets and pawls are specially hardened alloy steel — *every* load-holding ratchet is tested at 30,000 lb.

Housing is certified malleable iron to protect hoist from rust and damage.

Handle is designed to bend before hoist is overloaded beyond safe limits.

For full details, write for Bulletin O10L.

IN PUNISHING "DROP TEST," the Super Power had to withstand the shock of a 10,000-lb load dropped 4 in.— *an impact load of over* 40,000 *lb.* After several hundred such tests of Super Powers, there has never been a hoist failure!

COFFING HOIST COMPANY • DANVILLE, ILLINOIS

Originators of the Ratchet Lever Hoist

QUIK-LIFT ELECTRIC HOISTS • HOIST-ALLS • MIGHTY-MIDGET PULLERS • SPUR-GEAR HOISTS
DIFFERENTIAL CHAIN HOISTS • LOAD BINDERS • I-BEAM TROLLEYS

New Literature

Equipment Catalog

A new 340-page standard products catalog has just been published by Link-Belt Company. The products shown fall into several major classifications. These include chains and sprockets for conveying, elevating, and power transmission. Tables of pre-engineered drives facilitate the selection of standard roller chain drives and silent chain drives. Also included are:

- Enclosed gear drives
- Ball and roller bearings
- Conveyor components
- Vibrating screens
- Power unloading scoops and many additional items.

Catalog 950 with its flexible cover and thumb index will prove to be invaluable to the engineer or lawout man. Clear and concise capacity charts and dimension tables will aid in rapid selection of standard products and stock items for new installations.

To get a copy, circle **No. E13** on Readers' Service Card, last page this issue.

Drilling Rig Brochure

A new brochure is available from Damco Manufacturing Company which describes the new line of portable drilling rigs. This brochure gives complete specifications and descriptions of the AR-1250 and the AR-2000. These new highly portable units described in the brochure are capable of fast seismograph shot hole, blast hole, water well or core drilling with just minor changes necessary for each operation.

To get a copy, circle **No. E14** on Readers' Service Card, last page this issue.

Corrosion Booklet

Pipe Line Anode Corporation has just released a new 8-page illustrated color booklet showing applications for magnesium anodes in tanks, oil well casing, heater treaters, offshore drilling platforms, ship installations, and flow lines. This booklet, entitled, "How To Combat Corrosion," is available now.

To get a copy, circle **No. E15** on Readers' Service Card, last page this issue.

Chain Catalog

"Stock Roller Chains and Sprockets" is the title of Catalog 754, a 64-page illustrated book just published for distribution by Diamond Chain Company, Inc. This new catalog covers a complete line of roller chain stock sprockets. The line includes minimum bore sprockets for reboring as well as finished bore and taperlock bushed sprockets which are ready for use. Chain selection and application data are included.

To get a copy, circle **No. E16** on Readers' Service Card, last page this issue.

Gas Valve Bulletin

A new 8-page Okadee bulletin 54-S gives complete data on U. L. Approved Okadee Valves for LPG service. All valves described in the bulletin are disc valves, both single-seated and double-seated, which are UL approved for primary shut-off in LP gas lines. Other applications of the valves are illustrated in distribution manifolds, pump lines, bulk plant manifolds, twin-tank transport manifolds, and storage tank loading lines.

To get a copy, circle **No. E17** on Readers' Service Card, last page this issue.

Casing Patch Brochure

A new four-page brochure on a specialized tool called a casing patch is now available from its manufacturer, the Bowen Company. This brochure describes a tool which serves as an effective connection which simplifies permanent restoration of a damaged casing string. The bulletin also covers operation, use, parts and assembly.

To get a copy, circle **No. E18** on Readers' Service Card, last page this issue.

Welding Fittings Catalog

A revision of its W-3 catalog on Weld-Olets and ThredOlets for piping service has recently been published by the Welding Fittings Division of Bonney Forge & Tool Works. The catalog includes text and illustrations concerning WeldOlets, used in butt-welding and socket-welding, and ThredOlets, used for making threaded outlets.

The 36-page ordering and engineering reference book provides sizes, weights, prices, installation instructions, and a technical section covering design, engineering, and material specifications.

Special reference graphs in this section make it easy to determine code reinforcing requirements. Temperature-pressure ratings are also listed.

To get a copy, circle **No. E19** on Readers' Service Card, last page this issue.

Pipe Clamp Catalog

The MB Skinner Company has just published a new catalog and manual showing clamps and saddles for steel and cast iron pipe. It contains large color illustrations and cross-section detail drawings of the company's line of pipe repair clamps, service biddings and drilling equipment, plus complete descriptions and specifications. Several completely new products are shown for the first time. Two of these, the coupling saddle and the wall service fitting, are particularly interesting to gas and water men.

A series of installation pictures and captions for each clamp provide clear and concise instructions for the repair of all types of pipe leaks.

To get a copy, circle **No. E20** on Readers' Service Card, last page this issue.

Lightweight Vise that's also a Work Bench... it's

RIDGID

Tristand

...with built-in folding tray

Stand and tray are all one unit—no loose parts. Quick easy set-up and take down. Extra-light weight but strong, rigid. Full size vise base—3 benders, ceiling brace screw, pipe rest, lots of tool slots. An unbeatable value—see it at your Supply House!

Tray pushes up easily to fold Tristand, pushes down easily to set up. Holds stand rigid.

Folds up for easy carrying to job and it's extra lightweight.

The Ridge Tool Company • Elyria, Ohio, U. S. A.

RIDGID

Work-Saver Pipe Tools

New Books, Maps and Movies

BASIC OIL GEOLOGY, William W. Porter II, S.B., A.M., Second Edition, Gulf Publishing Company, 3301 Buffalo Drive, Houston, Texas.....$4.

A new book by William W. Porter II, S.B., A.M., has been published by the Gulf Publishing Company, publishers of WORLD OIL. The author is a member of the American Association of Petroleum Geologists and a member of the American Institute of Mining and Metallurgical Engineers.

The first edition of this book appeared in 1938 with the title *The Practical Geology of Oil*, and though it is now rather thoroughly revised, it is not enlarged but is somewhat reduced, in keeping with the original intention of producing a concise, easy reading analysis of geology.

The geology discussed in this second edition is really basic not only to oil geology but to any geology. The book is intended to give the busy reader who has not studied geology a basic understanding of the principles of geology and of what geologists can do, without attempting to impart to the reader the skill with which to do these things himself.

This concise presentation will suffice for many interested but busy people. As for those with the time and inclination to investigate the subject further: it is the hope of the author and the publisher that any additional reading in geology may be done with greater profit for having read first this brief basic analysis.

A 144-page cloth-bound book in the handy size of five by eight inches, it is illustrated with 21 photographs, cross sections, drawings, and maps. Subject matter, as indicated by chapter headings, touches upon the fundamentals of geology, elements of an oil field, common minerals, rocks, erosion, geological time, fossils, sedimentation, the crust of the earth, structural geology—folding and faulting, concentration of oil, unconformities, methods of drilling, well logging, coring, formation testers, geophysical methods, productivity of oil fields, and sources of geological information.

•

GEOLOGY OF THE THOREAU QUADRANGLE, VALENCIA AND McKINLEY COUNTIES, N. M., Dr. Clay T. Smith, New Mexico Bureau of Mines and Mineral Resources, Socorro, N. M. $1.

This is a detailed report on the Grants uranium area in northwestern New Mexico. Research for the report was carried out cooperatively by the New Mexico Institute of Mining and Technology and California Institute of Technology. It is accompanied by a three-color map showing all formations which are potentially productive of uranium. The study also discusses ground water occurrences in the formations in the San Juan Basin.

•

POTENTIOMETRIC-MODEL STUDY OF EDGE WATER ENCROACHMENT, Warren J. Mason, Department of Publications, Colorado School of Mines, Golden, Colo. $1.

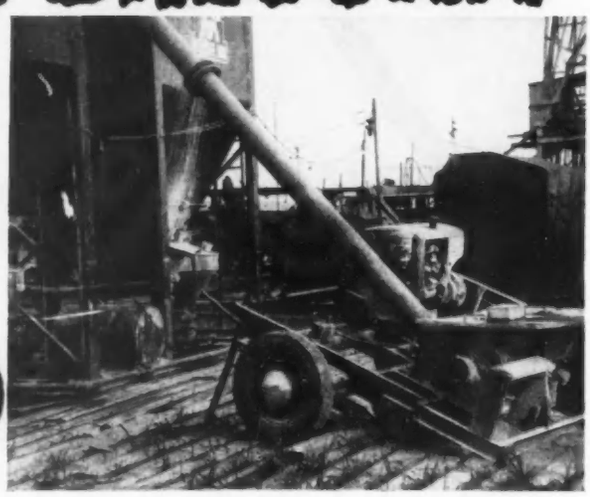
The latest quarterly issued by the Colorado School of Mines, this publication covers the use and construction of a potentiometric model for study of edge-water encroachment into the Tensleep pool of the South Elk Basin oil field. The study was made to try to establish the best production rate for each well so that the maximum amount of oil can be recovered by use of the natural water drive.

•

THE MIDDLE EAST, A Political and Economic Survey, The Royal Institute of International Affairs, New York Publications Office, 345 East 46th Street, New York 17. Revised Edition, 1954. $6.50.

Since the first edition of this book in 1950 developments have occurred which made the Middle East even more important to the rest of the world politically, economically and strategically. These developments have been dealt with in this new book and the facts and figures given are the latest available. The volume is intended to serve the specialist as a reference work and the general reader as a description of the region, its peoples and problems. It begins with a survey of the aspects of geography, history, politics, religion, sociology and economics which apply to the Middle East as a whole, followed by an analysis of history, importance, politics, social and economical structure and religion of Arabia, Cyprus, Egypt, Iraq, Israel, the Hashimite Kingdom of the Jordan, Persia, the Sudan, Syria, Lebanon and Turkey.

WISCONSIN-POWERED
"MUD BAZOOKA"
Gives Mud Drilling a Lift!



Power TO FIT THE JOB
Power TO FIT THE MACHINE

"Mud Bazooka" working in West Webster Field, Harris County, Texas

The advanced rotary drilling technique of employing Barium Sulphate Mud (4.3 times heavier than water), or other specified muds for carrying bottom hole drill cuttings to the surface and preventing blowouts, has brought about a demand for a new type of equipment . . . the "MUD BAZOOKA", shown here.

Mud material is hauled to the drilling rig in bulk trucks, dumped into the "Bazooka" hopper and a screw conveyor, operated by a 2-cylinder Wisconsin Air-Cooled Engine, elevates it to the storage bin. The base of the bin has an air operated valve manifold that accurately controls the discharge to any pre-determined mixture.

Tremendous time- and manpower savings are reported through the use of this new "Mud Bazooka" which takes the place of "manhandling" weight material (the bin in the picture has a 600-sack capacity). For this important service a Model TFD 2-cylinder Wisconsin Heavy-Duty Air-Cooled Engine provides dependable, steady-going "Lugging Power" that keeps the job moving.

Whether conveying mud materials, pumping oil or operating many other types of oil field utility equipment, you can't do better than to specify "Wisconsin Engine Power".

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MILWAUKEE 46, WISCONSIN
World's Largest Builders of Heavy-Duty Air-Cooled Engines

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OIL FIELD DISTRIBUTORS FOR WISCONSIN ENGINES AND ALL TYPES OF UTILITY UNITS

A 8072-3/2

(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

PETROLEUM MICROBIOLOGY, Dr. Ernest Beerstecher, Elsevier Press, 402 Lovett Boulevard, Houston, Texas. 1954. $8.

This book contains the first illustrated and detailed chapter written on actual use of bacteria in oil finding. Dr. Beerstecher tells how microorganisms can be specially trained to multiply only in the presence of hydrocarbon gases. Another chapter deals with uses of microorganisms in drilling muds. Activities of microorganisms in petroleum formations, both as they impede and promote secondary recovery procedures are considered in detail. A whole section for the oil refiner and petrochemical manufacturer discusses uses of bacteria in manufacturing. It is possible to produce a fair food product simply by bubbling gases through a column of bacteria.

•

TEXAS RAILROAD COMMISSION OIL AND GAS FORMS, R. W. Byram & Company, Drawer M, Capitol Station, Austin, Texas. $2.

This book is a guide to the preparation of the numerous forms which must be filed with the Texas Railroad Commission by the oil and gas industry. Beneath the photograph of each form is a summary of its purpose, the number of copies required, and where it should be mailed. All forms have been included which have been specifically adopted by the Railroad Commission and which are required by its orders.

•

BIBLIOGRAPHIC SURVEY OF CORROSION, National Association of Corrosion Engineers, M & M Building, Houston 2. Non-members N.A.C.E., $12.50; members, $10.

Summaries of 3512 corrosion and corrosion prevention articles, books and brochures published in 1948-1949 are compiled in this volume. Abstracts by 30 technical societies were canvassed regularly for material taken from more than 500 sources the world over. The subject index, in addition to terms in the N.A.C.E. abstract filing system, lists many metals and alloys by trade name and indexes them as to specific properties and to behavior in specific media. There are more than 2700 names in the author index. This is the third in a series of NACE bibliographies on corrosion literature.

•

ASTM-IP PETROLEUM MEASUREMENT TABLES, Metric Edition, London: Institute of Petroleum, 26 Portland Place, W.1.

When the British Edition of the ASTM-IP petroleum measurement tables was published in December 1952, it was announced that a metric edition was to follow to complete the trilogy—British, U.S.A. and metric. The metric edition has made its appearance and, in addition to a number of tables common to all volumes, it contains three tables particularly applicable to the metric system of measurement.

•

WHAT OIL CONSERVATION MEANS TO YOU, Interstate Oil Compact Commission, P. O. Box 3127, State Capitol, Oklahoma City 5.

This pamphlet in color portrays how oil and gas conservation serves the average person in maintaining an adequate supply of oil and gas for his transportation, home needs, extra leisure time, and for products essential to industry. Copies may be obtained free from the Commission. An actual printing cost of five cents per copy will be required in quantity orders.

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For Easy Upkeep
Safety
Efficiency

THE NEW "STREAMLINED"

WICHTEX

WELL SERVICING UNIT MODEL C-65

Here's the last word in trouble-free well servicing equipment—the newest Wichtex Model C-65. It's completely enclosed, reducing cleaning problems and increasing safety and efficiency. All bearings are lubricated at two points on each side of the machine. All Wichtex units are now available completely enclosed. Models vary from 1500 to 15,000 feet capacity. Write for catalog.

WICHTEX MACHINERY COMPANY INC.

WICHITA FALLS, TEXAS

(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

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